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Civil Engineering.

Letters from the United States of North America on Internal Improvements, Steam Navigation, Banking, &c., written by FRANCIS ANTHONY CHEVALIER DE GERSTNER, *during his sojourn in the United States, in* 1839.

(Translated from the German, by L. KLEIN, Civil Engineer.)

(Continued from page 301.)

LETTER V.

Macon, Georgia, May 1, 1839.

Legislative Acts concerning the Establishment of Railroads.

Each of the states, which form the American Union, is for itself, independent and sovereign, as the Federal Government at Washington is limited to some branches of administration only, while the principal legislation and government are left with the states. We therefore find in the twenty-three states, where railroads have already been introduced, much difference of legislation and manner of support of these works; the following points, however, may be mentioned, as common to most of the states.

1. *The right of way* for the road itself as well as for the stations, depots, etc., is procured either by free consent of both parties, or by appraisement in case of nonagreement. The appraisers are expressly instructed to appraise, not only the damage, but also the advantage arising to the landowners by the construction of the railroad. Two years ago when the railroad bridge across the Roanoke river, at Gaston, was to be constructed, the proprietor of the ferry at that place demanded 25,000 dollars, as an indemnification for his loss; but the appraisers estimated the increase of the value of the adjoining

lands, belonging to the same proprietor, at 20,000 dollars, and he had to content himself with 5000 dollars. In many cases land owners were induced to cede, without compensation, the necessary land for the railway, and in forests the use of timber in the line of the road, because his profit, arising from the increase in the value of his property, was as large or larger than the value of the ceded land. In Europe, appraisers have, to my knowledge, never estimated the profit arising to the land proprietor by the construction of a railroad or any other road.

2. *Location and grades.* In all states of the Union it is left to the Railroad Companies to determine themselves the line, profile, etc., of the railroads. In the charters the two terminating points of the line only are generally specified, seldom one or two intermediate points. The Companies, or the Boards of Directors, have therefore full, free action, but the Directors and Engineers are answerable to the Shareholders and the public, for the adoption of the best route, and cannot, as it is often the case in Europe, and principally in France, excuse themselves with the assertion that a plan, when once sanctioned by the higher authorities, is to be regarded as the plan of the latter, and Directors and Engineers are no more to answer for it.

3. All the iron rails, etc., necessary for the construction of a railroad, may, according to an act of Congress passed several years ago, be imported duty free. Although flat bars are rolled in several American iron works, the English iron is preferred here on account of its lower price.

4. The Officers, Conductors, Engineers, and other persons employed on railroads, are, in most of the states, exempted from militia service.

5. The charters are granted to railroad companies free of charge; in a very few cases only a certain per centage of the revenue is to be paid to the State Government. In most of the states the railroads are free from taxation.

6. Some of the charters grant exclusive privileges, in conformity to which no other railroad can, within twenty or even fifty years, be established at a certain distance from the one chartered; the railroad, however, remains forever the property of the company.

7. The tariff for the transportation of passengers and freight is always based on liberal principles, and in no single case has the state made it as a condition, that troops, state property, the mail, etc., be transported at a lower price, than other passengers or freight.

8. Any damage done to the road, or the stealing of any object belonging to it, is severely punished; if by the injury done, as, for instance, the tearing off of a rail, the lives of the passengers should be endangered, it is lawfully to be regarded as a criminal offence.

9. Some of the states preserve to themselves the right to purchase the railroad after a certain period, but in every such case the shareholders are to receive back the capital expended, together with ten per cent. per annum, on the same from the day of the first instalment.

Subscription of Capital Stock by the State.

Besides the above enumerated general assistance on the part of the state governments, direct aids are often rendered to those companies upon whose railroads there is not sufficient traffic to yield sufficient interest on the investments of private individuals. In such a case the Legislature promises in the charter, to subscribe for and pay in a part of the capital stock as soon as the remainder of the stock is disposed of by private subscriptions. The landowners and merchants of the county adjoining the line, then take a part

of the shares, and the state the other. In the state of *Virginia*, by an existing law, the state subscribes for two fifths of the capital stock of every railroad, as soon as the remaining three fifths of the capital are subscribed by private individuals. Virginia now has 333 miles of railroads in operation, for which 5,000,000 dollars have been expended. The population of the state was, in 1830, only 741,648 whites, and 469,757 blacks, upon an area of 66,624 square miles. As the negroes cannot quit their homes, except when accompanying their masters on their journeys, we can only reckon eleven white inhabitants per square mile, as belonging to the traveling public, and since, as I have shown in my last letter, far the greatest part of the profit upon rail roads arises from the conveyance of passengers, Virginia, with her comparatively small population, would certainly be without railroads had not the state government taken such a liberal course towards their introduction.

Banking Privileges of Railroad Companies.

The establishment of banks, of which I shall have occasion to speak in my future letters, belongs to the most profitable undertakings in the United States. In some of the states the number of banks is so large, it is true, that the profit of the stockholders seldom exceeds 6 or 7 per cent., but in other states, on the contrary, the banks yield 10, and more, per cent. yearly dividend. In such states banking privileges have been granted under the condition, that the banking company establishes a certain railroad; of the instalments made by the stockholders in such case, one half is generally to be applied to the construction of the railroad, the other half for banking purposes. It is calculated that the bank will yield 10 or 12 per cent. interest, the railroad only 4 per cent., so that the whole capital invested brings from 7 to 8 per cent. interest, which is regarded as sufficient.

Four years ago the state of *Georgia* had no railroads, because the population at the last census was only 299,292 whites upon an area of 61,500 square miles, or five white inhabitants per square mile, and consequently private individuals would not embark their capital in railroads. The government resolved to establish a line of railroad, 134 miles in length, through the most difficult part of the country, at the expense of the state, with a probable cost of about 4,000,000 dollars, and to grant banking privileges for twenty-five years to three companies, under the condition that they construct 500 miles of railroads through the principal parts of the country. The cost of the latter will amount to 7,200,000 dollars, which sum is nearly all to be paid in by private individuals, as the state only promised to take stock in three branch roads to the amount of 600,000 dollars. There are at present in Georgia 182 miles of railroads in operation, the remainder are mostly in progress of construction, and the whole system of railroads in this state is expected to be completed in eighteen months. This state, therefore, which, in 1830, had a population of only five white inhabitants per square mile, will, within two years, possess 634 miles of railroads, or just as many as the whole continent of Europe now can boast of. The state contributes to their construction 4,600,000 dollars, and private individuals 6,600,000 dollars, both therefore 11,200,000 dollars. Without banking privileges private individuals would never have embarked in these undertakings, as the lawful interest in this state is 8 per cent., and capital may be safely invested at such high interest; but as soon as banking privileges were granted for a term of twenty-five years, with the provision that the notes of the companies be taken in payments to the state in their full value, the shareholders

found their investment a safe one, and the construction of three railroads was immediately begun. For the present the companies derive their profits nearly exclusively from the banking operations, but the rapid increase in the traffic upon the roads will augment the profit from the railroad itself from year to year, and in twenty-five years, when the charter for the bank expires, the intercourse upon these railroads will be sufficiently large that the shareholders may dispense with the banking privileges.

Loans from the part of the States.

In those states where banks, in consequence of their being so numerous, do not yield great profits, or where the governments will not allow of their multiplication, railroad companies often receive, on their application, loans guaranteed on the part of the states. The charter then usually contains the provision, that the company has to expend first 100,000 dollars of their own means, after which they receive state scrips to the amount of 50,000 dollars, the payment of the capital and interest of which is guaranteed by the state; when the company again expend 100,000 dollars of *their* means, they receive further scrips to the amount of 50,000 dollars, and so on. Other works, undertaken by private companies, and finished in part, have sometimes to be stopped for want of means, and the state, by guaranteeing a loan, forwards their completion. In every such case the railroad is mortgaged to the state, and its revenues, after deducting the current expenses, have first to be applied to the payment of the interest on the loans thus guaranteed. Of these loans part were negotiated in America, but the greater portion in England; the common rate of interest is from 5 to 6 per cent., and the scrips are usually sold at par, and sometimes at a premium as high as 10 per cent. Thus the Americans construct their railroads in part with British gold; they pay annually the interest out of the proceeds of their works, and the country enjoys the advantages of a facilitated intercourse.

The Debts of the States.

The Federal Government of the United States has, as is generally known, several years back paid off all debts, contracted since the war of independence, and, moreover, in 1837, distributed amongst the several states 37,500,000 dollars out of the surplus revenue. Since that time the general government has emitted treasury notes at different periods, but they have always been redeemed at maturity. The several states, however, have made considerable loans for Canals, Railroads, and Turnpike roads, and for Banking purposes. Only a small part of these loans was applied for common roads; the construction of which has almost entirely been abandoned in America, since a better kind of roads, that is *railroads*, were introduced.

From a statement recently made out from authentic information it appears that nineteen states of the Union have, since 1820, contracted the following debts, viz:

For Railroads, Canals and Turnpike roads	$98,001,244 39
For Banking . . .	51,315,000 00
For other purposes . .	4,804,759 28
Total . .	$154,121,003 67

Of which, however, a part was again loaned to companies of stockholders, and has to be repaid by the latter. The amount of loans guaranteed by the Legislatures in their last session, to railroad companies principally, is proba-

bly not less than 16,000,000 dollars; the public debts of the several states for Internal Improvements alone amount, therefore, now to about 114,000,000 dollars; the greater part of the loans is already realized, and the remainder will be obtained in the course of one or two years. Only a small part of the state bonds are in the hands of Americans, the greatest part was negotiated in England, and the bonds are either in England or in other parts of Europe. The United States pay, therefore, annually to Europe 5,000,000 dollars as interest on their debts for railroads, canals and turnpike roads, and this amount of interest will, in the next few years to come, be materially enlarged by the new works that are constantly undertaken. Few Americans are of opinion, that their country will be impoverished by paying, annually, such a large amount of interest, and at maturity also the capital borrowed; most of them are, on the contrary, convinced that the Internal Improvements have so much increased the prosperity of their country that not only the interest, but also the capital itself will be brought in before it falls due, and that the accomplished improvements will still remain as a surplus gain to the country. Might the same views predominate in the states of the continent in Europe!

Letter VI.

New Orleans, May 20, 1839.

Banks in Louisiana.

In my last letter I stated that the state of Georgia has granted banking privileges for twenty-five years to three railroad companies, under the condition that they build 500 miles of railroads in the principal lines of intercourse; that 182 miles of railroads are already in operation, and the remainder will probably be completed within two years. The legal interest in Georgia is 8 per cent., and private companies would never have undertaken to construct such large railroads, had the banking privileges not secured to them a fair interest on their investments.

In the state of *Louisiana* the scarcity of money is, notwithstanding the production of cotton and sugar, still greater, and the lawful interest is here 10 per cent.; private individuals, speculating with prudence, can profit even 15 to 20 per cent.; how could it, therefore, be expected that funds might be obtained for public works, which, in such a thinly settled country, cannot be expected to yield a great profit. And yet large undertakings have been executed in the last six or eight years in the state of Louisiana, supported nearly all by banking privileges.

1*st. Canal from New Orleans to Lake Pontchartrain.*

On the 5th of March, 1831, the state granted a charter for the formation of a company under the name of the "*New Orleans Canal and Banking Company;*" this company was to pay in 4,000,000 dollars, in 40,000 shares at 100 dollars, to construct a canal from the interior of the city of New Orleans, through the Cypress Swamps, to Lake Pontchartrain, and to apply the residue of the capital for banking purposes. The canal was to be sixty feet wide on the water surface, and deep enough to be navigated by vessels drawing six feet water. Within the city was to be constructed a basin, and on Lake Pontchartrain a sufficiently safe harbor; the work was to be commenced within one year, and completed within six years, or the charter was to be forfeited. The company can take a toll of thirty-seven and a half cents, at the maximum, for every ton of the vessel's tonnage, and after thirty-five

years from the passage of the act, the canal as well as the road constructed along side of it, belongs to the state, in consideration of which the company pays no taxes during thirty-five years—the period of their charter.

The construction of this canal, which is of so great importance for the city of New Orleans, was accompanied with very great difficulties; the Cypress swamps, through which the canal passes, being so injurious to the health, that during the time of the Cholera, in 1833, 6000 of the Irishmen occupied in excavating the canal, were buried on its banks. Although the canal is only six miles in length, the construction of it lasted from November 1831, to the 27th of December, 1835, when the first vessel passed through it; the total disbursement of the company was, to the end of December 1838, 1,350,000 dollars, and as it is intended to enlarge the canal next year to 120 feet, in order to make it navigable for steamboats, the total cost will probably be increased to about 2,000,000 dollars. The receipts on canal tolls have hitherto been

In 1836	$ 8,843 76
" 1837	13,227 24
" 1838 for canal tolls	18,275 84
" —— for turnpike tolls	3,109 70

From these receipts must be deducted the expenses of maintaining the canal, which are considerable, in consequence of the wages of a carpenter or mason being here three dollars per day, of a common laborer at least one dollar and a half. Without banking privileges, therefore, the company would not have found this a profitable undertaking.

2d. New Orleans Water Works.

On the 1st of April, 1838, the state of Louisiana granted a charter for the formation of a company with a capital of 3,000,000 dollars; this company was to provide the city of New Orleans with pure water, to construct the works, etc., necessary for that purpose, and to apply the residue of the capital for the establishment of "*The Commercial Bank;*" the company had further the obligation to expend annually at least 100,000 dollars, until the greatest part of the city and suburbs is provided with water. The payments for water, obtained from these works, was to be proportioned so that the company may get, in the first five years, a clear profit of 15 per cent. at the maximum, and in the following years only 10 per cent. After the expiration of thirty-five years the city may purchase the water works and its appurtenances at a price to be determined by appraisement, and five years after, or in any case within fifty years from the day of the passage of the act, the banking privileges expire.

In conformity with this charter, the company has constructed a large reservoir, into which the water is raised from the Mississippi by steam power, and then conducted through pipes, the aggregate length of which is already twenty-three miles, to the different parts of the city. A family of six persons pays annually twenty dollars as water rent, for every person over six two dollars additional; two children under fifteen years of age are counted for one person. The owner of a public house (hotel) pays fifty dollars per year, and three per cent. of the house rent. For a horse is paid three dollars, for a carriage three dollars, for a bath in a private lodging five dollars, for a bath in a public house fourteen dollars per year, etc. As yet not the fourth part of the city is provided with water, and nevertheless the expenditure of the company amounts already to 900,000 dollars. The revenue or water

rent was, in 1837, only 8,000 dollars, and in 1838 17,000 dollars; in 1839 the company expects an income of 25,000 dollars. It is clear that the works would not have been undertaken without the profits being secured by banking privileges.

3d. Gas Works in New Orleans.

To light the city of New Orleans with gas had been repeatedly tried by individuals without success, until a banking privilege was granted on the 1st of April, 1835, to a company, styled the "*New Orleans Gaslight and Banking Company.*" The capital stock is 6,000,000 dollars, of which only one-third has been paid yet; 450,000 dollars have been expended on the gas works, and twelve miles of main pipes and forty miles of lateral pipes were laid down, which conduct the gas to 3,500 lights. The company lays down the pipes to the housedoors, and the houseowner pays for the arrangements in the interior of the house. There is a gas-meter in every house, and seven dollars are paid for every 1000 cubic feet of gas consumed. The stone coal, from which the gas is obtained, comes from Pittsburg, 2000 miles down the Ohio and Mississippi rivers, and costs, notwithstanding, per bushel, of eighty-four pounds, only eighteen cents. The revenues of the gaslight company are much larger than those of the two companies formerly mentioned.

4th. American Exchange Hotel in New Orleans.

The population of the city of New Orleans consists in 25,000 French, 20,000 American inhabitants and 30,000 slaves, together 75,000 souls. In winter from 10,000 to 15,000 strangers arrive in the city, a part to enjoy the mild climate, and another for transacting business; but in summer, on the contrary, a great part of the population leaves the city, to avoid the then raging fevers. Still a few years ago there was a general complaint about the want of a good hotel, and who would have established such in a city, from which the greater part of the inhabitants hurry away in May, and do not return until the end of October? The state of Louisiana, therefore, granted, on the 26th of January 1836, a charter to the "*Exchange and Banking Company,*" fixing the capital at 2,000,000 dollars. This company was bound to erect a hotel at an expense of not less than 300,000 dollars, exclusive of the price of the ground. The stockholders, all Americans, erected a hotel, which more resembles a palace, and expended for the same 650,000 dollars. Although the annual rent of this house amounts to 30,000 dollars, still the expenses for the maintenance of such an establishment and principally of its outfit, are so large, that the company would never realize their profits without their banking privileges.

5th. French Exchange Hotel in New Orleans.

The French inhabitants of New Orleans are always in some kind of opposition with the Americans, and they obtained, in consequence, on the 9th of February, 1836, a charter for the formation of a company entitled the "*Improvement and Banking Company.*" The capital of this company consists of 2,000,000 dollars, with which a large hotel was erected in the French part of the city, and besides three steamboats purchased for excursions to the environs of New Orleans, the remainder of the capital is employed in banking. The banking privilege is granted for twenty-five years. The company erected the hotel in a most magnificent style, at an expense of 920,000 dollars, and expended 90,000 dollars for steamboats. The great

profits from the bank, together with the moderate ones from the hotel, the exchange and the steamboats, give an interest with which the shareholders are contented.

Railroads with Banks.

The landowners (cotton and sugar planters) in Louisiana have hitherto been much restricted in their operations, for the reason that the plantations require large capitals for their cultivation, which do not return until the end of the year. The plantations are here entirely worked by negroes, as the white labourers cannot endure the climate; the price of a negro from twenty to thirty years of age is from 1,500 to 2,000 dollars (at a public auction in Alabama, at which I was present, from 400 to 500 dollars were paid for negro girls of ten years of age.) Provisions, as grain, beef, pork, poultry, etc., are seldom produced in the Southern, but come from the Western states, as far as 2,000 to 3,000 miles, and their prices are, consequently, very high. A planter with but little capital, therefore, had to borrow money at an exorbitant per centage, the lawful interest in Louisiana being as high as 10 per cent. The state resolved, therefore, to create "*Real Estate or Property Banks*," in which the stockholders do not pay in their instalments in cash, but rather in bonds and mortgages on real estate, for which, under the guaranty of the state, loans are negotiated in Europe. The stockholders then have the privilege of borrowing money from the bank to the amount of one half the value of their mortgages, at an interest of 6½ per cent.; the dividends on the shares, however, are not paid annually to the shareholders, but added to the capital and divided only after a certain number of years. In this manner three Property Banks were instituted: the "*Consolidated Association*," with a loan from the state of 2,500,000 dollars, the "*Union Bank*," founded on a loan of 7,000,000 dollars, and the "*Citizens' Bank*" on a loan of 6,000,000 dollars, which latter, however, can be increased to double that amount. The loans for the first two banks were negotiated in London, that for the Citizens Bank, in Amsterdam. As the system of the property banks is regarded as excellent, and could be imitated in Europe, I think it of interest to communicate here an extract of the statutes of the Citizens' Bank, which was the last chartered, and for which the experience acquired in the other two banks has been made use of.

The charter of the Citizens' Bank was granted on the 30th of January, 1836. 1. The bank is founded upon mortgaged property to the value of 14,400,000 dollars, upon which security the state guarantees a loan of 12,000,000 dollars, or at the rate of 100 dollars for every 120 dollars worth of real estate. There may be mortgaged: cultivated lands, slaves, houses and lots in town, if they bring a rent; one fifth of the mortgaged property can consist in uncultivated lands. The lands are taken only at their cash value, and the titles to the lands have to be well proved. 2. The directors of the bank borrow upon the mortgaged property to the value of 14,400,000 dollars, the sum of 12,000,000 dollars, or at the rate of 100 dollars for every 120 dollars worth of the mortgage, and the state of Louisiana guarantees the payment of the capital and interest; the interest is 5 per cent., and the capital is to be repaid in five equal instalments in 14, 23, 32 and 50 years, from the 1st of February, 1838. 3. The bank transacts every business connected with banking, issues notes and bills, purchases and sells domestic and foreign bills, lends money upon real estate, buys and sells all kinds of securities and also precious metals, provided, however, that the loans, discounts, and other advances taken together do not exceed double the amount of the

effective capital of the bank. 4. The rates of discounts of the bank cannot exceed 6 per cent. for bills payable within 124 days, 7 per cent. for bills payable after 124 days, and 6½ per cent. on loans upon mortgages. 5. The state of Louisiana is authorised to borrow from the bank 500,000 dollars at 5 per cent. interest, on the same terms as are fixed for the stockholders of the bank. 6. As all the stockholders of this bank mortgaged their property for their instalments, they may, on depositing their shares, borrow from the bank one half of the amount for which their property is pledged; but they are obliged to repay at least one year before the expiration of each of the periods, mentioned under No. 2, 20 per cent. of the sum borrowed. If, therefore, all the stockholders avail themselves of this privilege, the bank has to lend 7,200,000 dollars to the stockholders at 6½ per cent. interest, and can only carry on the other business with a surplus capital of 4,800,000 dollars. 7. Private individuals, who own no stock of this bank, may borrow money from the bank upon real estate for a term of ten years, but must repay each year at least one tenth of the capital. 8. Individuals who are building houses, may borrow from the bank to the amount of one half the value of the lots and buildings, but have to pay 7 per cent. annual interest, and besides 1 per cent. for commission. 9. The bank cannot issue notes of a smaller denomination than five dollars. 10. Each stockholder is at liberty to sell his shares, but the purchaser has to give a security upon real estate, to be approved of by the majority of the directors. 11. During the term of the charter of fifty years, the bank does not pay any state or county taxes. 12. The state nominates six, and the stockholders, also, six directors. On the first Monday in February of each year, all directors are newly elected. The President, who has the principal management of the affairs of the bank, receives a salary, but not the other directors. 13. After the bank has paid the interest at 5 per cent. on the loan negotiated in Holland, and defrayed all expenses incident to the management of the bank, the net profit is disposed of in the following manner, viz: the state of Louisiana, for lending its credit, receives one sixth of the profit if all 12,000,000, and one twelfth of the profit if only 6,000,000 dollars were borrowed; this part of the profit is to be applied for the primary schools in the state. The annual dividend of the stockholders is put to their credit, until the first instalment of the loan is paid back; after this the stockholders get one fifth of the profit and the remainder is again put to their credit until the second series of the loan is repaid, and so on. After the payment of the last series in fifty years, the stockholders receive the whole dividend.

The advantages of this bank to the planters in Louisiana is so great, that its results are already every where visible, and in the course of a few years the situation of the planters, who formerly were in the hands of usurers, will be still more materially improved. The shares of the company do not bring any dividends yet, as the profit is only put to their credit; but they sell now, three years after the bank went into operation, at 120 instead 100 dollars, or at an advance of twenty per cent.

TO BE CONTINUED.

The Laws of Trade applied to the determination of the most advantageous fare for Passengers on Railroads. By CHARLES ELLET, JR., ESQ., C. E.

If any explanation were needed for the publication of this paper, it is probable that a sufficient one might be offered in the fact that the railroads now constructed, and in progress of construction, in this country, will cost

from two to three hundred millions of dollars; and that the tariffs of charges are nearly always the result of the most vague conjecture, and frequently such as greatly to reduce the revenue which they might be made to yield.

The writer has elsewhere exposed the incorrectness of the present method of assessing the charges on heavy tonnage, and endeavoured to offer the means by which, it is believed, the proper rates may, on that part of the business of the work, be determined with great certainty. The present paper is intended to extend the application of the same principles to the matter of fares for passengers on railroads; a question which is equally susceptible of being subjected to a process of accurate reasoning, and which furnishes equally correct premises for the foundation of the argument. And if these premises have been justly assumed, and the conclusions fairly deduced, it may be averred, without risk of exaggeration, that the neglect of the results obtained from them, induces a loss to the proprietors of the railroads in this country alone, amounting annually to several millions of dollars.

The establishment of the tariff for an important improvement, is a momentous question for the company; and one which requires as careful an investigation of the facts, and the exercise of as much sound judgment, as any other which the engineer is likely to encounter in the course of his professional practice. The most consummate skill may be applied in the location and construction of the work and its appendages; and the entire success of the enterprise may still be marred by the subsequent injudicious administration of its affairs.

But it is not for the computation of the charges only that an attention to the requirements of the laws of trade is essential to the prosperity of the undertaking. In deciding on the character and location of the work, and adopting a system of transportation, it is equally imperative. It is as impossible to select the most appropriate plan of construction, and make choice of the most advantageous location, without a proper regard to the amount and nature of the business to be transacted, as it is to assess the charges without an attention to the cost of freight, and the value of the article to be conveyed. A road intended for the accommodation of a trade of 100,000 tons, or passengers, will generally be placed on very different ground, and ought always to be built in an entirely different manner, from those which would be adopted if a trade of but 10,000 tons were anticipated. In both cases, the inequalities of the natural surface must be more or less removed, for the purpose of reducing the expense of transportation; but the outlay justifiable for this object is wholly governed by the value of the object, which is dependent on the amount of trade. The heavy excavations and embankments are made for the purpose of reducing the price of freight; and if the trade be 100,000 tons, it will be worth 100,000 cents, or 1000 dollars, per mile per annum, to reduce the cost of transportation one cent per ton per mile. This sum is equivalent to a capital of some 16,000 dollars—the expense which might be incurred on each mile of a road of such expectations, in order to reduce the freight the amount designated. But, if the trade is to be only 10,000 tons, the same object, by this reasoning, would only justify an outlay of about 1,600 dollars; and consequently the road intended for the light trade would, of necessity, be placed on very different ground from that which would be chosen for the other.

The outlay should never be more than commensurate with the object for which it is incurred; and, therefore, the first and most important data to be provided by the engineer, in the incipiency of the enterprise placed under his professional guidance, are the value of the object contemplated by the

undertaking—the amount of the trade expected to be accommodated—and the extent of its dependence on the arrangements which he dictates; data which can only be obtained and appreciated by an attention to the laws to which the trade is subject.

The prosecution of these considerations will lead at once to the conclusion, that incalculable sums of money have been sunk in the improvements of this country, in reducing the irregularities of surface on works of small pretensions: That on such roads the grades ought to be comparatively steep; tunnels, deep cuts, and all similar expensive works should be avoided; and the hills and valleys, for the passage of which they are designed, should be crossed by increasing the acclivity of the grades and the length of the line. The superstructure, also, both of wood and iron, as well as the location, should be adapted to the trade; and the dimensions and weight of the engines and cars should be governed by the same considerations, and adapted to the intention of the road, and the character of the superstructure.

If the trade be great, the road must be made to correspond with it; and the foundation may then be immovable; the rails of iron, the track of great width, the acclivities gentle, the velocity slow, and the weight and power of the engines adequate to the movement of the heaviest trains. In the former case, the size of the engine might be limited to two or three tons; and in the latter, it may be extended to twenty or thirty. The cars on the light road may be made for the accommodation of eight or ten passengers; and on the other, if we choose, they may resemble moving palaces, and be provided with almost all their comforts.

All the arrangements must be subject to the control of the real or anticipated trade; and the character of the work, as well as the administration of the affairs of the line, must depend on the application of the principles which we have attempted to develope under the appellation of the "Laws of Trade." Our present study relates to the latter department—the administration of the line, in reference to the question of

The Fare for Passengers on Railroads.

The principles which have served for a guide to the results announced in the preceding articles,* are not less useful in the determination of the charges proper to be levied on railroad passengers. There are, however, difficulties to be encountered in this division of the subject, which do not always obtain in the discussion of the laws which govern the trade in heavy commodities of small value, previously considered; and which, though they cannot be thought to leave the general results at all exceptionable, may render the employment of the formulæ embarrassing in some particular applications. But yet, it is believed that by the division of the whole subject between the question which has for its object the calculation of the charges proper for particular lines, connecting important places, and the wider problem, to determine what should be the fares common to several connected railroads, that their aggregate net revenue may be the greatest possible—it will be relieved of many of its difficulties.

In reflecting on this problem, the first inquiry which presents itself is, what are the circumstances which govern an individual in deciding on the propriety of undertaking a journey? for if there be no law to which his decision is subject, there can be none to govern the charges exacted for his

* Referring to a series of articles, of which this paper will constitute one, published in the Railroad Journal for the present year.

conveyance. But, fortunately for our purpose, there is one very important consideration which, in this commercial age, appears to control all the enterprises of man in civilized society, and to the application of which there can be no exception made in favour of his traveling propensities. This is the consideration of *cost, or hope of gain.* The profits of business, curiosity, or the prospect of pleasure, incites to embark on the voyage; and the *cost of the journey*, whether it consists of the value of his time, the importance of his personal attention to his home-affairs, the desire to yield to the dictates of indolence, or the amount of his traveling expenses, urges the party to remain. He reflects on these opposite considerations, and forms his conclusions; and the result is, with very few exceptions, that he cannot afford to set out if the cost of stage *fares* will exceed a given sum. They who are to transport him have no control over any item which enters into his computation of the cost, but this; he puts his own estimate on the value of all the other considerations, and balances the account as his judgment and feelings admonish. And his final conclusion depends on the comparison of the sum which he thinks he can afford to pay for his fare, with that which the companies are disposed to exact. It matters not, for our present purpose, what this limit, which he chooses to prescribe for himself, may be—whether it amount to one dollar, or to twenty dollars—providing it be admitted that there is a sum to which each individual, after considering all the circumstances—all the charges—the advantages sought, and the inconveniences to which he will be exposed, limits the amount that he will rather pay for his fare than decline the trip.

An individual thus situated is in precisely the same condition with reference to the proposed excursion, as an article of merchandise in which he trades; there is a certain sum which may be charged for his conveyance without excluding him from the route; he will go if he is charged no more than that sum, and if charged more he will remain;—just as he will send his corn and lumber to market, if the charge for their conveyance will authorize him to do it, or retain them in his ware-house or in his forest, if the charge be higher than he can afford to pay. He makes the same sort of calculation with reference to his journey as that which he institutes in deciding on the propriety of shipping his goods.

And, if we were now able to separate the public into classes, and fix appropriate values on these classes, to represent the charges which they could afford to pay—as we can separate and value the different varieties of tonnage—the problem would be readily solved; for we would then have only to apply the equations already deduced for heavy tonnage,* to each class, by inserting in the formulæ the ascertained values of π, and obtain from them as many correct results as we should find varieties in the traveling community. But, in the present case, we cannot proceed in this way, since we are compelled, by the consitution of society, to charge all—or at least all who receive the same accommodation—alike; and consequently, before the formulæ could be employed, it would be incumbent on the company to find, among all these infinite grades, that one which, if made the basis of the tariff, would yield the highest revenue. The company do not, however, know whether the value which represents this particular grade is a constant quantity, or whether, as appears probable, it may not be a function of the distance, or otherwise complicated.

To avoid these difficulties it will be necessary to pursue a different route;

* Essay on the Laws of Trade, p. 63-5.

and assume, as authorized by the preceding remarks, that in every town on the line, or in every square mile of the country, there is a certain number of persons who can afford to make an excursion to some given point on the railroad—as the great city from which it issues—providing the cost of the trip shall not exceed a given sum. That there is another number that can afford to pay twice that amount—others three times that sum, and so on, until we arrive at the limit which would almost preclude traveling. We will also assume that the number of individuals in each of these classes is the same; or that there are three times as many who cannot afford to pay three dollars as there are of those who are unable to pay one—the number of persons excluded being directly as the sum which represents their grade; or, it may be assumed that for every increase of the cost of reaching the point in question, the number of passengers will be diminished; and that the diminution of the number will be proportional to the augmentation of the cost.

The investigation, based on these premises, will embrace two distinct cases, which appear to be the most important that are likely to be encountered in the course of the application of the principles to practical purposes. The business of the line will be assumed to be constituted either of the travel which proceeds from the large cities on the route, and which usually form the termini of the works of the separate companies; or of that which is thrown upon the main trunk by tributaries of greater or less consequence.

This discrimination is prompted by the consideration that it would seem proper for the separate companies to regulate the charges to be exacted of those who traverse their respective lines only; but that the rates to be levied on the distant traveler, who purchases his ticket and pays his fare "through," should be adjusted by the co-operation of all the parties. And the questions proposed for solution are: 1st. To determine the proper charges to be exacted of those who proceed from the cities on the line of the road, and who, for the most part, will pay over one line only; and 2d. To ascertain the law which should govern the prices to be paid by passengers who are brought to the principal route by its tributaries. These questions are too complicated to be treated without the aid of mathematical formulæ, and we will therefore designate by

π the greatest charge for conveyance which any grade of passengers can afford to pay;

ς the gross charge per mile on the railroad;

δ the freight, or actual expenses per mile per passenger on the railroad;

c the toll, or clear profit per mile per passenger on the railroad;

β the charge for conveyance, per mile, on the tributary;

h the distance from the assumed origin to the tributary.

Now, it is obviously proper to assume that if the fare on the road connecting two cities, as Philadelphia and Baltimore, were reduced to zero, and the public were carried free of charge, the number of travelers passing over the road, exclusive of those brought to the line by tributaries, would be some constant quantity, T; and it has already been assumed that for every increase of one cent in the charge, the number would be reduced some quantity represented by the co-efficient, t. The whole number of passengers proceeding from these cities will then be expressed by the equation

$$T - \varsigma h t; \qquad (1)$$

since ςh is the gross charge between the two places. The clear profit

which will be derived from the transportation of this number of persons will then be represented by

$$(T - c' h\, t)\, c\, h;$$

a quantity which will attain its maximum value when the condition imposed by the equation,

$$c\, h = \frac{1}{2}\left(\frac{T}{t} - \delta\, h\right), \qquad (2)$$

expressing the charge on each passenger, exclusive of the actual expenses, is fully satisfied.

If to this quantity we add the actual expenses, $\delta\, h$, we shall obtain for the proper value of the gross charge,

$$c\, h = \frac{1}{2}\left(\frac{T}{t} + \delta\, h\right). \qquad (3)$$

From which we conclude that under the circumstances assumed, the gross charge which will yield the highest revenue on all the travelers who pass between the two cities, at which they reside, will be obtained by *adding half the actual expenses to a certain constant quantity.*

The value of this quantity can readily be obtained by experiment. For this purpose we are to note the reduction of the number of passengers produced by any augmentation of the fare; from which we derive, by supposing the increase or decrease of travel proportional to the variation of the charges, the reduction caused by the whole charge $c' h$. This reduction, added to the number actually obtained under that fare, will produce the value of T; and consequently of the fraction $\frac{T}{t}$.

Now, the only objection to this argument is the assumption that the diminution of travel is proportional to the elevation of the charges on the line; a postulate which cannot be proved to be correct.

Indeed, it is probable that a given variation of the charge would produce very different values for the co-efficient t, at the extreme limits of the sums designating the elevations of the grades. But, it is to be recollected that the equation can never be applied at these limits; since in practice the charges can never descend as low as $\delta\, h$, or the actual expense of conveyance, nor ascend as high as the sum which would justify the establishment of a rival. The space through which the charge can possibly range, is confined within certain bounds, not very well defined, it is true, but still sufficiently restricted to destroy the chance of any material error arising from this source. And consequently within these bounds it appears safe to assume that the *increase* or *decrease* of travel (not the travel) will be proportional to the elevation or depression of the charges.

According to the form of equation (1) there is a certain charge for conveyance so high that, if exacted, passengers would be entirely excluded; and we should therefore have, $T - c' h\, t = o$; from which would be immediately deduced $\frac{T}{t} = \pi$, the value of the highest grade in the community.

In fixing on the sum which represents the ability of this highest grade, if we choose to make use of this expression, we should not, of course, be governed by the occasional passenger whose wealth will authorize him to pay almost any sum for the gratification of his fancy. The expression can-

not be extended beyond the class of which the number is sufficient to contribute materially to the support of the work. It is not, however, essential to the attainment of the greatest income that the determination of this point should be very accurate; and for the object now in view—the discovery of the proper method of graduating the tariff—it is a matter of still less consequence.

In passing to the second, and more important, problem which we have proposed to investigate, we will assume that when the charges for fare, both on the main line and its tributary, are zero, the number of passengers received from each mile of the latter will be represented by any constant quantity T; and that for every increase of the whole cost of conveyance to the place of destination, amounting to a unit of price, the number of passengers will be diminished the quantity t; we shall then have, for the reduction of the number of passengers furnished by any increment of space dx, situated at the distance x from the main line, due to a charge ς per mile for fare on the railroad, and β on the tributary,

$$(\varsigma h + x\beta)\, t\, dx;$$

and, consequently, for the differential of the whole number supplied by the tributary, the expression

$$d\,\mathrm{N} = \mathrm{T}\, d\, x - (\varsigma\, h + x\, \beta)\, t\, dx.$$

The integral of this expression will represent the whole number of passengers, of every grade, supplied by the space consisting of x miles, measured from the main line along the tributary; and we shall therefore obtain by performing the integration, for the value of this quantity

$$\mathrm{N} = \mathrm{T}\, x - \left(\varsigma\, h\, x + \beta \frac{x^2}{2}\right) t. \qquad (4)$$

Now, the highest grade of passengers supposed to come on the work by the branch in question, as we have already seen, is $\pi = \frac{\mathrm{T}}{t}$; or the grade which renders the quantity $\mathrm{T} - \pi' t$ equal to zero. And if we deduct from this value of π, the whole charge for conveyance on the main line, the remainder, $\frac{\mathrm{T}}{t} - \varsigma\, h$ will stand for the sum that the portion of the community represented by π can afford to pay for conveyance on the tributary after paying the charge on the main line.

The distance which this grade can afford to travel on the tributary, will be represented by the quotient obtained in dividing this sum by the charge per mile for conveyance on the tributary—a quotient which is expressed by the equation

$$\frac{\frac{\mathrm{T}}{t} - \varsigma\, h}{\beta} = x.$$

If we now substitute this value of x in the above value of the number of passengers furnished by the tributary, we shall obtain the new equation

$$\frac{\mathrm{T}^2}{2\,\beta\, t} - \frac{\varsigma\, h\, \mathrm{T}}{\beta} + \frac{\varsigma^2\, h^2\, t}{2\,\beta} = \mathrm{N}, \qquad (5)$$

relieved of the quantity x, and completely expressing the number of tra-

velers, of all grades, destined to the assumed origin, thrown upon the railroad by the tributary under consideration. And if we now multiply this quantity by c, the toll or clear profit per mile, and substitute $\delta + c$ in place of ζ,—differentiate the expression, and place it, as required by the rule, equal to zero, we shall arrive at the condition represented by the equation

$$\frac{T^2}{3\,h^2\,t^2} - \frac{2\,T\,\delta}{3\,h\,t} + \frac{\delta^2}{3} = \left(\frac{4\,T}{3\,h\,t} - \frac{4\,\delta}{3}\right)c - c^2.$$

This is a quadratic equation, from which we obtain, after clearing it of the radical, for the toll or clear profit to be derived from each passenger,

$$C\,h = \frac{1}{3}\left(\frac{T}{t} - h\,\delta\right); \qquad (6)$$

where the charge is understood to apply to the whole distance h, through which the passenger is carried. By adding to this quantity $\delta\,h$, or the actual expense of conveyance by railroad, we shall obtain,

$$C'\,h = \frac{1}{3}\left(\frac{T}{t} + 2\,h\,\delta\right) \qquad (7)$$

for the gross charge which should be levied in order to obtain the highest dividend; an equation which again shows that *the whole charge which should be exacted of any passenger is a constant quantity augmented by two-thirds the actual expense of his conveyance.*

Although there are numerous subordinate questions connected with this problem, the two cases now examined cover the most important that can arise in the application of these principles to practical purposes. The equations resulting from the first will aid to frame the tariff on separate lines; while those of the second may be applied to lines of greater length, and constituted of a number of distinct interests.

It is not, however, necessary to make this distinction, unless there be sufficient reason to believe that the values of the fraction $\frac{T}{t}$ differ essentially for the two classes of travelers. This will be made manifest on a comparison of equations, (2) and (3) with (6) and (7); for we find by these expressions that both the toll and gross charge obtained for the two cases, are of the same form, though differing slightly in value; and that the amount of this difference is but one-sixth the whole charge—a sum entirely too trifling to produce any appreciable effect on the revenue of the work. It is not pretended here to obtain the exact charge which would yield the highest dividend, within ten or fifteen per cent.; but it is the object to point out a method by which to avoid the common errors of such tariffs—errors which are not unfrequently five, and indeed much oftener more than ten times that amount. The loss of revenue may be wholly imperceptible when the deviation from the true charge is 10 per cent.; but it must be remembered that for every dollar that is lost, on heavy tonnage, by an overcharge, or an under-charge of 10 per cent., there will be experienced a loss of one hundred dollars for ten times that deviation. *The loss increases as the square of the departure from the charge which corresponds with the maximum revenue.** It is not essential to hit the exact mark, but it is exceedingly

* *Essay on the Laws of Trade*, p. 152.—The increase is not so rapid in the present case, but it is still very great indeed.

dangerous—certain indeed to be followed by great loss—to deviate too wide from it.

Such are the equations for the computation of the rates which must be established when it is determined to enforce in practice a rigid adherence to the principles which have governed the investigation. But, before proposing a rule for general usage, it will be proper to notice a modification which may be made in the formulæ, and ascertain the probable consequences of its adoption. Occasion has already been found in the course of these articles to advert to that peculiarity of quantities which have attained a maximum or minimum limit, of being very slightly affected by a considerable increase or diminution of the value of the variable. In the question under discussion the variable which affects the amount of the revenue, is the charge for toll; and, in consequence of this property, if we increase that quantity, as determined by the calculation now offered, any small amount, although the number of passengers, of the grades that are influenced by their traveling expenses, will be simultaneously reduced, the additional tax levied on the remainder will be almost sufficient to compensate for the loss due to the decrease of the number. Now, the whole charge for toll is

$$\frac{\pi}{3} - \frac{h\delta}{3};$$

and if we observe the form of this quantity, we will perceive that an increase of this charge equal to the second member, $\frac{h\delta}{3}$, would amount, for any distance over which it would be possible, or desirable, to enter into a general arrangement, to a sum too small to produce any sensible reduction of the revenue. If, for instance, we assume six dollars for the value of $\frac{\pi}{3}$, one cent per mile for that of δ, and 500 miles for the distance h—which last assumption is nearly equivalent to supposing that the arrangement is adopted by all the companies between New York and Raleigh, N. C.,—the effect of increasing the charge per passenger as suggested, the exact value of $\frac{\delta h}{3}$, would be to increase the net income per passenger, or charge for toll at that distance, but $37\frac{1}{2}$ per cent.; while it has been shown that an increase much greater than this amount, on heavy tonnage, (Art. 2,) would not essentially reduce the revenue,—and at 500 miles the increase would be but 20 per cent., and the diminution of revenue nearly imperceptible.

We would, therefore, be authorized in permittimg such a departure from the formulæ by these considerations alone, if there existed no other argument in its favour: but it will be observed that the equation (6) was deduced in the hypothesis that every individual using the line is more or less affected by the charges; an assumption which, although in this country almost universally true, is not without exceptions—for it must be admitted that there is a portion, though a very small part, of the traveling community, scarcely influenced at all by this consideration. We have not the means of estimating the actual or comparative number belonging to this class; but there is cause to believe that the proportion which it bears to the whole number of persons traveling increases materially with the increase of distance. We also know that the effect of this modicum, if taken into the account, would be to augment the charge for toll; and, consequently, if al-

lowed for in the above expression of the net income per passenger, that equation would assume the form

$$C\,h = \frac{\pi}{3} + f h - \frac{\delta h}{3};$$

in which, as before observed, we neither know the form nor the exact value of the junction $f h$—nor whether it be greater or less than $\frac{\delta h}{3}$—though we do know that these quantities, besides being of opposite signs, are both too small to have any serious effect on the revenue. This sum might even be a positive quantity; but, for reasons already adduced in justification of the neglect of $\frac{\delta h}{3}$, unless that positive quantity were one of very considerable importance, and much greater than the negative quantity $\frac{\delta h}{3}$, its neglect would have no visible influence on the revenue. We will, therefore, be authorized to regard these quantities as very nearly equal; and consequently neutralizing each other. The preceding equations (6) and (7) will then become

$$C\,h = \frac{\pi}{3}, \qquad (8)$$

for the value of the toll, or clear profit, per passenger, and

$$C'\,h = \frac{\pi}{3} + \delta h, \qquad (9)$$

for the gross charge for conveyance.

The rule which should be proposed for computing the tariff, will be drawn from the formulæ as modified by these considerations; and it may be expressed in few words—*add to the constant quantity which experiment dictates for the profit per passenger, the actual cost of his transportation*—to obtain the gross charge to be exacted for his conveyance.

The objection which may be urged against the importance of these equations, on the ground of the uncertainty which must attend any attempt to determine à priori the exact value of the constant quantity which enters them, is without force. It would be idle to expect any solution of the problem which would entirely dispense with the exercise of a discriminating judgment, or deprive experience of its usefulness. The formulæ teach us the law by which the charge must vary as the distance increases—and the only unknown quantity may be accurately determined by one or two judicious trials; without their assistance years of experience and the most accurate observation, will still leave the subject involved in the greatest uncertainty.

It will readily be perceived that, by the principles here advocated, there may sometimes be good policy in making a distinction between the different grades of travelers carried on the road; and in adapting the rates levied upon each grade to its actual ability. But, it is probable that such distinctions would be found productive of inconvenience sufficient, in this country, to limit them to two classes—the first consisting of those who regard *cheapness* as more important than the superior comforts and more select society offered in the best class of cars, and the second, of those who are willing to

pay something for these considerations. But the principles already announced for the assessment of the charges will be applicable to both these divisions;—they will each be required to pay, besides the actual cost of their conveyance, a certain tax, proportional to their respective ability, to go towards the profit of the company; and though the former part of the charge will vary with the distance, the latter part will be the same, whether the visitor to New York take the line at Baltimore, Richmond or Raleigh. The utility of such discriminations is, however, very doubtful unless made with a full appreciation of all the circumstances.

It need scarcely be said, that in fixing the charges for a long route made up of several distinct interests, an agreement between the companies composing it, to prevent injustice from being done to either, is an assumed condition. The method proposed aims for the maximum *aggregate* net income; the equitable distribution of the proceeds among the companies, will involve no difficulty, for the profits of any one line, derived from individuals who pay their fare over that line only, will, of course, belong exclusively to that company; but the profits obtained from tickets over two or more lines, will be divided among the several companies in proportion to the number of miles of travel on them respectively.

It may also be observed that the application of the system is not to be extended to roads so short that the quantity representing the profits would be such as to justify the establishment of a rival. The actual value of this constant must first be ascertained and applied to the distant travel; and if it amount to a higher sum than it would be deemed advisable to charge on the separate roads, or than their charters would permit them to exact, they would be at liberty to make the needful modifications. The regulations adopted on the lines taken separately, would be independent of those which would be applicable to the common interest.

It is not denied that there are plausible objections to the process which has conducted to the conclusions presented in this paper; and that it may not possess all the accuracy that is sometimes attainable in similar researches. But it does, nevertheless, seem to be the nearest approach to a rigorous solution of which the important, but complicated, problem is really susceptible.

Withal, the simplicity of the result adapts it peculiarly for general use, and renders its application exceedingly easy on the longest and most complicated lines. It is offered as an attempt to elucidate a subject which seems not yet to have occupied the attention of the profession, or of railroad companies—but which possesses the highest interest, both as a question of profit, affecting the dividends due to the greatest investment of capital ever made for any one object of public improvement; and as a question of political economy, involving the measure of the benefit to be derived from the railroad system.

Franklin Institute.

Appendix to the Report of the Committee on Premiums and Exhibitions on the 11th Exhibition of Domestic Manufactures held by the Franklin Institute.

Report of the Committee of Judges on Cotton Goods.

To the Committee on Premiums, &c. of the Franklin Institute.

Your Committee on Cotton Goods have examined the several specimens submitted to their inspection, and respectfully report thereon as follows:

No. 249.—3-4 undressed chintz prints, from the American Print Works. These are highly creditable to the manufacturers—are printed with great care, and exhibit superior workmanship.

3-4 Fall River chintz prints—a good article, and well supports the established reputation of that manufactory.

No. 939.—3-4 black ground prints, printed by Marshall & Co., New York, highly commendable; the ground colouring very clear and perfect, and the shading and printing very accurate.

No. 818.—3-4 chintz prints, from the Taunton Print Works, a very beautiful and chaste style, reflecting great credit on the manufactory. These goods are conspicuous for the neatness and taste displayed in the patterns. The work generally well executed, although a few slight inaccuracies are observable in the printing.

3-4 Merrimack dark chintz prints. These goods well sustain the character which this manufactory has so long enjoyed for producing good work.

No. 629.—6 pieces 4-4 chintz prints, printed by J. Dunnell & Co. These goods are of superior excellence, colours and finish very good—printing, consisting of several colours, unusually perfect, style beautiful. Your committee consider these prints the best exhibited, and think they merit special notice.

3-4 chintz furniture prints, from the Fall River Works, a rich and beautiful article, of good style and perfect work—these rival the imported.

Power loom ginghams, made by James C. Kempton, said to be the first goods ever wrought by 3 shuttles in Power Loom—the entire execution of these goods, including dyeing, is very superior. Your committee believe that in England they have long endeavoured to invent machinery to weave checks and plaids by Power Loom, without success, and would suggest that the invention should be suitably noticed.

Power Loom checks also made by James C. Kempton. The above observations apply to these goods, as similar machinery is employed in manufacturing them.

No. 257.—White cotton counterpanes, a substantial and handsome article, highly creditable to the manufacturer—large quantities of the foreign fabric are consumed. For the manufacturing of these goods a great weight of the raw material is required, on which account your committee are of opinion that this branch of manufactures should be encouraged.

No. 219.—4-4 coloured rolled Silesias, good cloths and colours; a fair specimen of an article now much used for linings, as a substitute for the imported.

No. 879.—Cotton yarn No. 80, from the Rockland Manufacturing Com-

pany, a beautiful specimen of fine yarn. Your committee not being conversant with the state of the manufacture of this article, deem it proper to say so, that the manufacturer may not be deprived of his deserts by reason of their imperfect knowledge.

Nankeens and Chambrays, made from the natural coloured Georgia cotton—the former of these articles has become one of general use for men's and boy's wear, and is very serviceable for its durability of texture and colour.

No. 290.—Shoe thread, made by Smith, Dove & Co., Andover, Massachusetts, an excellent article, strong, and of uniform fineness, apparently fully equal to the imported—the "putting up" exactly resembles the foreign article, of which large quantities are annually consumed.

No. 674.—Cotton and woolen hose, shirts and drawers, made by John Hopkins; very good samples of these very useful articles, of fair texture, and for durability and service, at least equal to the imported. As yet the manufacturing of these articles at home is not extensive.

Samples of bleached shirtings, from several manufactories, were exhibited, of superior quality. The market has long been supplied with this description of goods, of so excellent a character, and at so low a price as almost entirely to exclude the foreign article.

Sundry samples of ticks, checks, plaids, Canton flannels, paper muslins, white and coloured cambrics, cotton handkerchiefs, and shawls, suspenders, &c., were exhibited; all excellent in themselves, and for which description of goods the trade has long depended almost exclusively on the domestic manufacturer.

Before closing this report your committee would remark that the variety of cotton goods exhibited at this time is not so great as on former occasions; this is to be attributed to the fact that many articles which formerly were novelties, have, owing to the increase in their production, ceased to be so, and are no longer thought to be objects for exhibition—another reason is, that manufacturers, who are preparing new articles intended for sale the coming season, are naturally averse to expose to the view of competitors specimens which might be copied to their own pecuniary disadvantage. It is believed that no article belonging to our department was manufactured with a view to be exhibited, but that all were gathered from warehouses, which contain packages of the same goods for sale. At the present period the assortments are much broken, and consequently unfavourable for obtaining samples for exhibition. Your committee, in conclusion, think that the vast and rapid improvement and increase in the manufacturing of cotton goods, affords ample cause for congratulation.

Philadelphia, Oct. 19th, 1840.

Report of the Committee of Judges on Iron and Steel.

The Committee appointed by the Franklin Institute of Pennsylvania, for the purpose of examining sundry specimens of iron and steel, respectfully report that they have attended to the duty assigned them, and having examined the specimens as well as circumstances would permit, proceed to give their opinions of the several articles submitted to them, viz.

No. 418.—A lot of anthracite pig iron, deposited by W. R. Johnson.

No. 753.—Anthracite pig iron, made by Baughman, Guiteau & Co.

Also samples of pig iron made by Biddle, Chambers & Co., deposited

by Morris & Jones. The metal in both samples of anthracite iron, appears to be of various qualities, and gives us every reason to suppose that iron may be made with anthracite of as good quality as the iron made with Bituminous coal.

The samples from Biddle & Chambers, appears to be well adapted to foundry purposes.

No. 494.—Castings by Levi Morris & Co., from anthracite iron, particularly two fine heads, similar to the Berlin castings, and exceedingly well done; also some other specimens by the same gentlemen, that are very creditable to them, and evincing improvement in this very important branch of the arts.

No. 581.—Samples of iron deposited by Morris & Jones, viz. 3 sheets of boiler iron, of unusually large dimensions, one of them is 10 feet 6 inches in length by 31 inches broad, made from charcoal blooms, in the usual way by Yearsley & Forsyth, made at one heat for each sheet, and very handsomely rolled; the quality of the iron is said to be very good.

Four samples of iron made from charcoal pig metal, puddled with wood and anthracite. This iron is of good quality, made by Betolett and Co.

One sample of iron from charcoal pig metal, puddled with Bituminous coal, by Keim, Whitaker & Co.—the appearance of this iron is good.

One piece of iron from charcoal hot blast, pig metal, made by the run out process, at Coleman's Iron Works, Mastic Forge, Lancaster county, and is of a superior quality.

One piece of round iron from anthracite pig metal, from the Crane Iron Works, made into bar iron at the Boontiss works, with anthracite coal.—This iron is of good quality, and deserves to be particularly noticed, as it goes to establish the fact that good iron may be made with anthracite coal exclusively, and also with a great saving both of metal and fuel; it is stated by the maker that the whole waste of metal during the conversion does not exceed 12 per cent. Such facts, we think, are very encouraging to those engaged in making these experiments.

No. 579.—Several specimens of iron, deposited by E. J. Etting & Brothers, made by Valentine, Thomas & Co., at the Bellefonte & Juniata Iron Works. This iron is very well made, and appears fully to sustain the reputation it acquired at the last exhibition.

Two samples of iron from the Howard pig metal, made by Valentine, Harris & Co., deposited by Etting & Brothers. The character of the iron made from this metal is so well known that it does not require any recommendation.

No. 708.—One card of spikes and 2 horse shoes, made by the Troy Manufacturing Co., by Henry Burden. Also one card from the Albany Iron and Nail Works, at Troy, by J. F. Winslow. Both samples are made by machinery, and are very handsome articles—there appears to be so little difference in them that we would decline recommending one in preference to the other.

No. 487.—Four sulkey backings, made by G. E. Dunn, of Newark, N. J., which are considered very fine specimens of smith work.

No. 495.—Three bars of steel from American iron, converted by J. Robbins, Jr.; it is not superior to some that has been brought forward at former exhibitions. Also 2 or 3 bars from the same maker,—a very good article,—the committee, however, are not certain that it is made from American iron, as it is not stated by the depositor whether the iron is Domestic or foreign.

Philadelphia, Oct. 20th, 1840.

Report of the Committee of Judges on Musical Instruments.

The Committee on Musical Instruments Report:

In deciding on the merits of the twenty-one piano fortes which were exhibited in competition, the committee have had special reference to the following particulars:—

1. The tone; its clearness, purity, sweetness, force, brilliancy, equality throughout the scale.
2. The touch.
3. The action, including dampers, &c.
4. The structure of the instrument, its durability, its power to stand in tune, the facility of tuning and repairing it; involving the proportion and arrangement of its parts, the mechanical execution, materials, &c.
5. Economy of construction, in combination with other particulars.

External appearance was regarded as an independent consideration, not immediately affecting the technical excellence of the instrument.

In comparing the tone of the instruments, each was in the first instance fully tried by at least three performers, in the presence of the committee, and a few were marked by their unanimous decision, as decidedly inferior to the rest in this particular. When two or more of the remaining instruments were presented from the same workshop, the best of them was next fixed upon after renewed trials. The competitors for the first rank, thus ascertained, were again tried repeatedly, and the number gradually narrowed down by comparisons. Of the few that remained, after numerous and varied trials, the instruments having been brought together and placed in circumstances altogether similar, a selection was made by secret ballot; and to ensure as far as practicable an unbiassed decision, care was taken to avoid all prior communication of sentiment between the members of the committee.

The character of the touch was next determined by the members of the committee, who are performers; and as they concurred in opinion, the committee proceeded to inspect the action of the instruments. For this purpose, one instrument at least from each establishment, including every supposed variety, was opened, the action taken out, and every part of it examined in comparison with the others. At the same time, the entire structure of the instrument was judged of, with a view to its fitness and strength, and with reference also to its economy; the committee being of opinion, that of two instruments in other respects equal, a preference should be given to the one which had been produced by the smallest expenditure, and could be sold therefore at the lowest price.

The committee are unanimously of opinion that of all the instruments exhibited, the highest praise is due to one of six octaves, made by Brown & Hallett, of Boston. It is a very small instrument, the smallest indeed in the whole collection; but its tone is superior to any other in the particulars which constitute excellence. The touch, though not better than that of some others, is good. Its action differs but little from the most approved English action; it is neat and very well made, though except in the working parts, it is not so highly finished as several that are in the room. Its arrangement is convenient; it appears to have adequate strength, and the mechanical execution is altogether workmanlike. The disposition of the soft pedal, denominated by the makers, "new patent," avoids the necessity of shifting the action, and is remarkable for its simplicity and durability,

and for the extreme beauty with which it gives the monochord tone. It has, moreover, the recommendation of being a cheap instrument. In exterior appearance it is plain.

The piano next in rank, according to the judgment of the committee, is one of six and a half octaves, from the New York Manufacturing Company, No. 268, (exhibition No. 399,) except in the character of its soft pedal, this instrument approaches closely to that first spoken of, and was a powerful competitor for equal honour.

Of the other excellent instruments presented, the committee would specially notice those from the establishments of Thomas Loud, of Philadelphia, and Chickering & Mackay, of Boston. One of Mr. Loud's, in rose wood, of six and a half octaves, No. 2237, is remarkable in a very high degree for its admirable touch, its brilliant tone, its fine mechanical execution, and its apparent strength and ability to stand in tune. Those of Messrs. Chickering & Mackay, in rose wood and mahogany, have the characteristic excellence of the instruments from their establishment. A very highly finished instrument by Messrs. Bossert & Schumacker, of Philadelphia, (No. 420, examined,) should also be remarked for the finished mechanical execution of the internal parts, and the beautiful workmanship of the case.

A number of excellent flutes were submitted by Mr. Pfaff, and Mr. Weygandt, manufacturers, of Philadelphia. The preference of the committee is expressed in favour of those made by Mr. Pfaff, on Monzani's patent, on account of the superior accuracy of their scale, the quality of their tone, and the convenient structure of the keys. A flute, made by the union of successive layers of linen or cotton drawn tight over a mandril, also attracted notice as a highly finished instrument; but the peculiar advantages of its structure were not explained; the maker is Mr. Catlin, of Philadelphia.

A brass clarionett, E. Flat, by Mr. Pfaff, is a very highly finished instrument, and its clearness of tone would seem to fit it well for a place in a military band.

Mr. O. M. Coleman, of Philadelphia, submitted his Eolian lute, a beautiful and graceful instrument of his own invention and manufacture. It is in principle a double accordion, but the facility with which it ascends and descends the scale, the certainty of its tone, and its power of combinations, as well as its lute like form, properly claim for it a different designation.

The automaton minstrel of the same gentleman, and a parlour organ, by Mr. Knauff, arrived at the hall of exhibition so late as to preclude an examination of them by the committee.

Report of the Committee of Judges on Bookbinders' Work and Tools.

The Committee on bookbinders' work and tools, respectfully report, that they have examined very carefully the various articles enumerated in the annexed catalogue, and deem it necessary only to report specially upon those hereinafter set forth—the rest, in their opinion, require no particular notice; they are fair specimens of work, but are distinguished by no peculiar claim.

No. 31, by Abel & Pomeroy.—Specimens of bookbinders' work, exhibiting good workmanship and finish, and evidence of the general improvement of this branch of manufacture.

Nos. 22, 23, 24, by A. C. Morin, 29, by Gaskill & Copper, and 74, by

C. W. Lang.—Specimens of bookbinders' stamps, tools, and embossing plates, very creditable to the makers.

No. 40, by Lindsay & Co.—Many specimens of bookbinder's work, including volumes in quarto, the whole of excellent workmanship, and the best specimens of binding for general use that have ever been exhibited in this city. It is proper to remark, that the books were not bound for exhibition, but were the current work of the bindery of the exhibitors, who are entitled to the highest commendation for the perfection to which they have attained in their art.

No. 305, by Gaskill & Copper.—Bookbinders' tools. These are deemed the best specimens ever exhibited in this city, and are equal to the best of specimens of English workmanship.

No. 463, by Samuel Moore.—A single copy of Lalla Rookh, a specimen of binding of superior excellence, and the best bound single volume in the exhibition.

Philadelphia, Oct. 19th, 1840.

JOHN C. CRESSON,
ALEXANDER DALLAS BACHE,
ALEXANDER FERGUSON,
THOMAS FLETCHER,
ISAAC B. GARRIGUES,
JOHN S. WARNER,
JOHN AGNEW,
THOMAS U. WALTER,
JOHN STRUTHERS,
JOHN H. TOWNE,
Committee on Premiums and Exhibitions.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1839,
With Remarks and Exemplifications by the Editor.

1. For an improved *Double Catch Bolt Lock;* Conrad Liebrich, city of Philadelphia, October 5.

These improvements are applicable "to all those locks which have double catch bolts, to lay hold on two sides of a hasp, or staple." The particular devices by which it is intended to afford additional security, are not of a kind to be understood without the drawing in which they are represented, and to which the claims refer.

2. For an improved mode of *Converting a Rotary into a Reciprocating Motion*; Christian Wilson, Bedford, West Chester county, New York, October 5.

It appears that a principal object of this invention is to work the dashers of churns. For this purpose a weight suspended by a rope acts upon an axle on which the rope is wound; and this, by cog gearing, gives motion to a pendulum, from which a connecting rod extends to a bell crank, to which a dasher, &c. may be applied. The whole affair is not worth the trouble of description, as it does not present any thing new in principle, and the right under the patent can extend only to the special arrangement given.

3. For a *Mould Board for a Plough;* Samuel Witherow, of Gettysburg, and David Peirce, of Philadelphia, in the state of Pennsylvania, October 5. (See Specification in vol. xxv. p. 113.)

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4. For a *Black Pigment;* Nathaniel Chater, city of New York, October 5. (See Specification.)

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5. For a *Molasses Gate;* Jervice Whittemore, city of Boston, Massachusetts, October 9.

In this molasses gate a tube enters the barrel in the usual way, and is furnished at its outer end with a sliding gate to close the aperture, but this gate, instead of consisting of a flat piece of metal, forms a segment of a circle, of four inches radius, the plate, or tablet upon which it bears being of the same degree of curvature. A steel spring proceeds from the opposite sides of the tube, and these springs work upon joint pins at their back ends, and are bent round in front so as to bear upon the sliding gate, and keep it in close contact with its seat, or tablet. The gate is operated by means of a rack and pinion.

The claims are "to the mode of arranging the springs for keeping the gate firm in its seat, by attaching them to the sides of the socket, upon the tube, and making them movable upon it as a centre, and conducting them along said tube, and securing them to the centre of the gate as above described. And in combination therewith, and necessary thereto, making the tablet and gate of a curvilineal shape; the tablet forming a segment of an arch, so as to allow of the radial steel springs describing a motion on their pivots."

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6. For a *Plough for Prairie Lands;* Josiah Dutcher, city of New York, October 9.

The claim under this patent is, first, to "the manner of constructing the share, by forming it of a wide flat plate, with two or more rows of holes for attaching it to the mould board, for the purpose of shifting it forward as it wears, and with the fore end of said plate turned up as described, so as to form a cutting edge, whilst its plane coincides with, and forms a part of, the mould board. Also the manner of sustaining the front part of the share by placing its vertical portion between the centre and the flanch cast upon the mould board, and by passing a bolt through the whole, as set forth; also the projecting piece, or stop, bearing against the heel of the plough, for the purpose of sustaining the back end of the share."

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7. For a *White Cement, or Artificial Stone;* John D. Greenwood, and Richard W. Keene, Great Britain, October 9.

(See Specification.)

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8. For an improvement in *Hanging Carriage Bodies;* Azima Vallerchamp, McDowellsville, Columbia county, Pennsylvania, October 12.

"The nature of this invention and improvement consists in a certain new and useful combination and arrangement of springs fastened to the perch of the carriage, and straps and buckles attached to said springs, and to the under side of the carriage body when arranged in a pendulous, or self balancing manner, on the elliptic or other springs, for preventing the body swinging too far transversely; the longitudinal swinging being prevented

by straps attached to the front and hind ends of the carriage body, and to the upper side of the perch."

The claim is to the combination and arrangement of the springs and straps, as indicated in the above extract from the specification. The straps are, in fact, check straps, and do not present any great novelty, though enough, it seems, to justify the grant of a patent.

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9. For an improved *Smut Machine;* John B. Yates, Sperryville, Rappahannock county, Virginia, October 12.

A vertical cylinder of cast iron, is to have the interior of its sides fluted from top to bottom, and its bottom is also fluted or divided into ridges, like a mill stone. To this cylinder there is to be a top, through a hole in which the grain is to be admitted; as it falls down it is struck forcibly by revolving beaters, which force it against the tooth-like flutes at the sides, and rub it, in some degree, against them and on the bottom. Through an opening in the bottom, it passes to a cleaning apparatus. The claim is to the before described beaters constructed with horizontal wings at their bottom, in combination with the fluted cylinder as described."

By those familiar with this subject it will be seen that this machine differs but little from several which have preceded it. The form of the beaters is, in fact, the only peculiarity, and this difference is, literally, rather in form than in substance; the office is sometimes blamed for granting such patents, but in general, unjustly, as where the identity of two things is a disputable point, it is the duty of the office to leave the matter to the courts.

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10. For an improvement in the *Ever-pointed Pencil Case;* Jacob Stockman, and Samuel W. Hopper, Assignees of W. Simons, Philadelphia, October 12.

In an article like the ever-pointed pencil case, which is composed of several distinct tubes, and other parts, combined together, the peculiarities upon which any new claim rests cannot be understood without a full representation of the whole; all that we can offer in the present instance, therefore, respecting the article before us, which is a very neat one, and does not appear to be liable to get out of order, is as follows. The point is protruded by drawing out and returning a tube at the lower end of the case, and is returned to its place by a similar movement; resembling that of Lowndes' case, which is operated on at the cap, or upper end. The inventor says that "by this arrangement of the several parts of the pencil case, it is simplified in its construction, the friction is lessened, and there is little liability of its getting out of order. The derangement consequent upon giving the requisite motions by the screw cap of the pencil is also avoided." The claim is to the particular arrangement, as set forth.

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11. For an improved *Hub and Axle for Carriage Wheels;* John Loudon, Aubern, Cayuga county, New York, October 12.

The patentee says, "I make the hubs, or naves, of my wheels of cast iron, or of any other suitable metal, and bore out the cavity which is to form the box for the reception of the arms of the axle, from the inner end thereof, leaving the outer end solid in that part where the nuts and caps which confine the axles and boxes together, are usually applied. The screw collar or cap, which I employ for that purpose, being situated at the inner end of the hub." The screw collar which is used is divided into two parts, and has a male screw cut upon it which screws into the rear end of the hub. A

recess in the axle constitutes an oil box, and there is an elastic packing to prevent the escape of the lubricating material.

There is considerable resemblance between this manner of making the hub and axle, and that which was patented by Mr. Delano, between whom and Mr. Loudon there was some dispute respecting the invention; it is believed, however, that there has not been any interference between the two, legally established.

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12. For a *Machine for Planting Corn;* N. R. and O. G. Merchant, Guilford, Chenango county, New York, October 12.

There is but little difference between this machine and a number of others already in use; the only claim made is to "the manner of varying the distance of dropping the seeds by changing the lever to different rows of cogs in the hub, as described." It is not worth while to give a long account of the particular device adopted in the present case, as it does not appear to present any special advantage over other plans for effecting the same purpose.

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13. For improved instruments for *Manufacturing Barrels, Kegs, &c.;* William G. Burr, Mount Pleasant, Westchester county, New York, October 12.

The claims under this patent will afford a good general idea of the nature of the things invented, and are as follows:

"*First.* The manner of constructing the instruments for turning and champfering the heads of such vessels. Said instrument consisting of the forked lever, carrying the three cutters, and being held down upon the rest by a holdfast and weighted lever, formed and operating as set forth.

"*Secondly.* I claim the apparatus for centering and holding such vessels whilst being turned; said apparatus consisting of a mandrel, with jointed arms, operated upon by sliding wedges, which are forced forward and retracted by means of a band and pulleys, or by means of screws, or other known mechanical devices producing a like effect.

"*Thirdly.* I claim the within described instruments for turning or truing the ends of the staves, and for performing the operations of beveling, howeling, and crozing the barrel or other vessel; the respective cutters for that purpose being attached to a cutter bearer, in the manner set forth."

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14. For machinery for *Reeling, Spinning, and Twisting Silk;* Jacob Pratt, Sherburn, Middlesex county, Massachusetts, October 12.

This machinery, as represented in the drawing, embraces the whole apparatus for performing the above named operations; but its construction is, in general, similar to such as is well known, and is not claimed as new, the claim being limited to the "using a trough of zinc, partially filled with warm water, in which are arranged the spools from which the raw material is to be wound for spinning." The object of keeping the spools so immersed is stated to be "to keep the fibres from adhering to each other or the bobbins, by keeping the gelatinous substance in a state of solution." No particular reason is given for making the troughs of *zinc*, and we suppose that copper would do equally well; but from the special mention of this metal we were led to look for some ground of preference to it.

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15. For *Hanging Carriage Bodies;* Dimon B. Barnum, New Fairfield, Fairfield county, Massachusetts, October 16.

This is a very simple contrivance, not having much claim to novelty, and, we apprehend, not very likely to produce much litigation on account of its value. The carriage body is to rest upon spiral springs coiled vertically around a shaft. This arrangement affords vertical, but does not allow of any lateral, motion.

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16. For a *Mowing Machine;* A. P. Trask, and D. Aldrich, Ellington, Chautauque county, New York, October 16.

The claim made is to the "placing the two front wheels on which the mowing machine moves, within the wheel of scythes, as described; and also the revolving rake for laying the grain in gavels, regulated in its action by the arrangement of the rods and wires, as described, in combination with the wheel of scythes."

In the general construction of this machine, so far as the cutting by means of scythes arranged around the periphery of a wheel revolving horizontally, near the ground, is concerned, it does not present any thing that is new; the claim is, therefore, confined to the details above pointed out, which may probably be productive of some advantage.

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17. For improved *Metallic Stop Cocks;* Ari Davis, city of Boston, state of Massachusetts, October 16.

This is, we believe, an entirely new and a good mode of making a stop cock for gas, and for other purposes. It is not furnished with a key the plug of which passes through the bore of the body of the cock, but with one which has an appearance like the head of such a key cut off from its conical portion. The opening through the cock is bored in from each end, leaving a solid portion in the middle, or the bulb portion thereof. The bore then turns up at right angles, forming two openings on the top of the cock. The key, which is flat on its under side, covers these openings, and has a chamber in its head, which affords a passage to a fluid when turned in one direction, but cuts it off when turned a quarter round. Between the flat bottom of the key, and the top of the cock, there is a piece of leather, or other suitable substance, interposed. The key is held down by a small screw bolt passing into its centre, and through the body of the cock, between the two apertures bored into it.

The claim is to "the mode of arranging the canal, by carrying it up after it reaches the bulb, then into the head of the key, and down again on the opposite side into the bulb, as described."

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18. For an improvement in *Circular Saws;* Jonathan Gove, Fayetteville, Cumberland county, North Carolina, October 16.

(See Specification.)

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19. For a *Smut Machine;* Leonard Smith, Plattsburg, Clinton county, New York, October 18.

We are hoping for a truce in the examination of smut machines, which have become very numerous, whilst many of them appear like twin brothers, so much alike as to require a very intimate acquaintance with them to recognize their individuality at first sight. We shall, in the present case, give no further description of the above named machine, than that afforded by the claim, which claim would answer equally well for half a dozen different members of the same family.

"What I claim as my invention, and wish to secure by letters patent, is the combination of the beaters with the fans, grates, and heads, constructed and operating as described."

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20. For *Protecting Iron from Oxidation;* Palmer Sumner, and Peter Naylor, city of New York, October 18. (See specification.)

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21. For a *Smut Machine;* Luther B. Walker, Orangeville, Genesee county, New York, October 18.

The claim is to "the constructing of smut machines with internal beaters, having curved plates, or wings, as described; and in combination with the above, the discharging tubes, or spouts, also as described." There is something more special in the arrangement of this machine than in many others for the same purpose, but the peculiarities could only be made known by a longer story than we are disposed to tell, unless we were aided by engravings.

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22. For a *Re-action Water Wheel;* Timothy Rose, Windsor, Broome county, New York, October 18.

This re-action wheel, which is similar in its general construction to those that have been most extensively used, in which the water is admitted on one face of the wheel, and is discharged at its periphery through a series of openings between overlapping curved buckets, in a direction tangential to the wheel. The improvement consists merely in making the head of the wheel at which the water is admitted larger than the lower or back head, so that its periphery will form the frustum of a cone. The patentee avers that he has "experimentally proved that the power of such a wheel is much increased by giving to it this form," and claims "the making the buckets to flare out from the back, or bottom plate, to the rim, or face, so as to enlarge the openings of the latter, in the manner set forth."

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23. For a *Wheel for Railroad Cars;* David Cockley, city of Lancaster, Pennsylvania, October 21.

This wheel the patentee calls a "single plate and bracket wheel." Instead of spokes, or arms, it has a single concavo-convex plate joining the nave and rim, and this is strengthened by brackets, which on the convex side of the plate bear against it and the rim, and on the concave side, against the plate and the nave, or hub.

The claims are to "the employment of brackets on the back, or convex side, to support the rim; and also the additional length of the hub, with a bore sufficient to receive the axle of its full size, as a safety in case of the axle breaking at the shoulder, also as described." The additional length spoken of is made by extending the back of the hub so as to cause it to surround the larger portion of the axle, behind the shoulder, which, however, it does not touch. The additional safety from this device is not very apparent, and certainly is not great.

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24. For a *Spark Arrester;* William Knight, Chambersburg, Franklin county, Pennsylvania, October 26.

The chimney in which the sparks are to be arrested consists of two tubes one within the other, the inner tube being perforated, through its whole length, with numerous small holes, or it may be made principally of wire gauze. The two tubes are connected at top by a rim which incloses the

space between them, whilst the interior tube is left open. This inner tube is closed at the bottom, excepting for the admission of the exhaust steam pipes, which discharge through it. The direct draught from the fire is between the two tubes; and from this space it must pass through the perforated tube, in order to escape at the top of the chimney.

The claim is to "the perforated tube extending the whole length, or a considerable portion of the length, of the smoke pipe, and having its lower end closed, excepting the apertures for the admission of the tubes through which the exhaust steam from the cylinders are admitted to pass into it."

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25. For an improvement in the *Piano Forte Action;* Hiram Herrick, city of New York, October 26.

This is a matter but little understood, excepting by those who are piano forte makers, and the variations in the action of these instruments are numerous; that which is the subject of the present patent appears to possess some mechanical advantage, which, however, cannot be fully made known without drawings. The claim is to "the manner in which I have arranged the fly, or jack, in reference to the hammer butt, so that by the depression of the key, said fly, or jack, shall approach the forward end of the hammer butt, and finally escape in front of it."

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26. For an improvement in the machine for *Mitreing and Dovetailing Boards and Plank:* Richard Urann, city of Boston, Massachusetts, October 26.

A patent was obtained by Mr. Ari Davis, for a machine by which the mitreing and dovetailing were effected by circular saws; this patent was obtained on the 31st of August, and was noticed in its proper place. The machine patented by Mr. Urann is very similar to this, but in the claim to his patent, Mr. Urann says that his "improvements consist entirely in dispensing with the use of saws, and effecting the whole object by means of cutters, in the manner set forth; I therefore claim as my improvement, the employment on the same disk, of the cutter for cutting the mitre on the end of the board, and another for one half of the dovetail, or groove, in combination with cutters on the second disk for completing the said dovetailed tongue, or groove; the whole operating substantially as described."

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27. For *Hanging Carriage Bodies;* Ira W. Britton, Medina, Medina county, Ohio, October 26.

In the specification of this patent, the patentee refers to the description of a rolling wagon reach described in Newton's London Journal, vol. xiii, p. 139, and vol. xiv, p. 121, of the first series; his invention being confined to the rocker joint only, which is to be added to the rolling reach above referred to. The rocker joint is a bar of iron, which is placed on the upper part of an elliptical spring, and works on a joint pin on its centre. The object is said to be "to prevent all straining or twisting of the springs and boxes, or bodies, of four wheeled carriages, when passing over uneven ground."

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28. For a machine for *Boring Timber:* R. Hubbell, assignee of Moses Hubbell, Hudson, Portage county, Ohio, October 26.

"The nature of my invention consists in having a portable machine running upon trundle wheels, by the side of the timber to be bored, with a crank and fly wheel for the augers, and appropriate machinery to gauge,

"What I claim as my invention, and wish to secure by letters patent, is the combination of the beaters with the fans, grates, and heads, constructed and operating as described."

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28. For a machine for *Boring Timber:* R. Hubbell, assignee of Moses Hubbell, Hudson, Portage county, Ohio, October 26.

"The nature of my invention consists in having a portable machine running upon trundle wheels, by the side of the timber to be bored, with a crank and fly wheel for the augers, and appropriate machinery to gauge,

elevate, and depress the auger, and to throw it back after having penetrated the timber." After this announcement, there are six large pages of description, making known the particular arrangements adopted by the patentee; and this is terminated by the claim to "the combination of the carriage for setting the auger at a proper height, and giving it a proper direction, with the slide containing the auger; the whole being applied to a portable frame, for the purpose, and in the manner described."

A machine of this kind may be constructed and modified in so many ways, without interfering with any of the special arrangements described in this specification, as to render such a patent of but little value, however ingeniously the machine may be constructed.

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29. For a new and improved *System of Music:* Thomas Harrison, Springfield, Clark county, Ohio, October 26.

The claim under this patent is to "the placing of the first seven numerals between, and over, and under, two parallel lines, thereby instituting three successive octaves, and affixing periods, commas, and hyphens, to the said numerals, in order to determine their relative length."

Whenever we see half a dozen pieces of music published upon this plan, we shall think it worth while to give some analysis of it, but as we do not expect ever to witness this, our readers will scarcely have their attention again called to this matter. Many ingenious attempts have been made to introduce new notations in music, but they have been still born.

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30. For *Clearing Snow and Ice from Railroads;* Thomas S. Ridgway, Pottsville, Schuylkill county, Pennsylvania, October 31.

The plan proposed of effecting the clearing of snow from rails consists of two principal devices. The first of these is the having heated air, or flame, forced on the tops of the rails in front of the wheels of a locomotive engine whilst running, in order to melt the snow and ice that may lay upon said rails. To effect this, there is a revolving fan wheel placed in a box appropriated to it, and situated against the front part of the smoke box; and from this fan wheel the sparks and heated air from the fire are to be directed on to the respective rails, through tubes fixed for that purpose; by which means the ice and snow are to be melted, and the rails dried.

The second device consists mainly of two heavy, cast-iron wheels, one for each rail, having an axletree, and so placed as to be pushed before the engine, and to cut the ice by means of their weight. These wheels have a number of wrought-iron teeth, with steel edges, inserted into their peripheries.

The claim is to "the forcing of hot air, sparks, &c., in the manner herein described, upon the rails of a railroad, for the purpose of melting the snow and ice that may lie upon them, and drying the rails when wet. Also the accompanying ice cutters, as described."

To us these means appear so inadequate to the production of the end proposed, that we are a little surprised at its adoption by a gentleman of intelligence. We may err in judgment in this matter, but we really cannot believe that all the heated air that could be thrown upon the two rails, from a locomotive furnace, would melt the ice and snow, when of a moderate depth only, at the rate of a mile in an hour.

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31. For a *Corn Sheller;* Samuel H. Kissinger, and E. G. W. Stake, Williamsport, Washington county, Maryland, October 31.

This corn sheller resembles that which was the first patented machine for the same purpose, in which the corn was shelled by means of a revolving cylinder, set with points, or teeth, and operating against an elastic concave. The improvements are indicated in the following claim.

"I do not claim to be the first to have invented an apparatus for shelling corn by means of a revolving cylinder set with teeth, this having been done in many other machines; but what I do claim as of my invention in the above described machine, is the manner in which I set the teeth in my cylinder, in combination with the double inclined plane, and with the two springs, constructed and operating in such a way as that two ears of corn fed in at the same time will be shelled, and the two cobs carried out at the opposite side of the machine."

The cylinder revolves horizontally, and the teeth are so set upon it as to tend to carry the ears, which are dropped in near to its middle, towards either end, where the cobs are delivered. The inclined planes are two boards which support the ears, and along which they descend, whilst pressed by two springs against the cylinder.

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32. For a machine for *Removing Stones, &c., from deep water*; Philander Lee, Syme, Jefferson county, New York, October 31.

"My machine consists of two pieces of timber about eight inches square, and four feet in length; these are fastened together at one of their ends, whilst their other ends are separate about four feet from each other. These timbers are firmly secured in their places by bars of iron passing diagonally from one timber to the other in such manner as to constitute an apron, or platform, upon which the bodies to be removed are usually drawn. Into the upper surface of the frame are inserted teeth, or bolts of iron, about one foot in length, and placed so near each other as to retain any bodies placed thereon during the removal."

Two tug chains are fixed to this apparatus, and these are connected by other chains crossing from one to the other, and forming a flexible apron in front of the inflexible part of the drag. By means of these chains, or of ropes attached to them, leading to windlasses properly stationed, the drag is to be drawn along on the bottom of the water.

The claim is to "the combination of the flexible apron, or net work, with the wooden frame, or platform, provided with teeth, &c., as herein described."

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33. For *Carriage Springs*; Sumner King, Suffield, Hartford county, Connecticut, October 31.

"The nature of this invention consists in making the leaves of springs convex or concave, transversely, instead of flat; by which formation they are rendered much stronger than the common springs. The greatest convexity, or concavity, is in the centre, and decreases gradually towards the ends, where the leaves are made flat for a proper union of the same." The claim is to the foregoing manner of forming the leaves.

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34. For a *Machine for Rolling Leather;* William Coburn, Mountjoy, Lancaster county, Pennsylvania, October 31.

"What I claim and desire to secure by letters patent, is the constructing a table having a concavity on its surface which is the segment of a hollow sphere adapted to the vertical sweep and roller, as herein described, by

means of which the roller may be passed over the leather in all directions, without the necessity of shifting the place of said leather.

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35. For an improvement in *Piano Fortes;* Alpheus Babcock, city of Boston, assigned to J. Chickering and J. Mackey, October 31.

This improvement is confined to that part of a Piano Forte action which is denominated the jack, or grasshopper, and the things claimed are the following: "Attaching the regulating screw to the fly, and making it movable with the same, instead of connecting it to the jack, as has hitherto been the case; and also in combination therewith, and as necessary to the operation of the same, the arrangement of the damper upon the inner end of the regulating screw, and the attaching of a pad, or cushion, to the inside of the jack, so as to deaden the stroke of the fly."

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36. For *Bearings and Oil Boxes for the journals of Cars, &c.;* John N. Tims, city of Newark, New Jersey, October 31.

The claim is to "the mode of using a sponge or other analogous substance in a box, or compartment, below the journal, for lubricating the same in the manner set forth; said oil box being constructed with a second compartment for containing such oil as may flow over from that in which the sponge is deposited, and for affording a fresh supply to the sponge as it becomes exhausted.—I do not claim the simply supplying the oil below the journal, but only in combination with the said box. I claim the arrangement for supplying the oil and allowing a portion of it to flow off by means of cocks arranged and combined as herein described. I claim the particular manner in which I have constructed the journal and its bearings, in combination with the foregoing lubricating apparatus, consisting in the fillet, or tongue, the recess for checking the lateral motion of the bearing, the respective grooves, and the cap or washer of leather for retaining the oil, in combination, as set forth."

It will be seen that a description, of no mean length, would be required to designate the particular mode of constructing all the parts above referred to.

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37. For *Heel Plates for Boots and Shoes;* W. and W. N. Lewis, city of New York, October 31.

"The nature of our invention consists in the combination of a plate of metal, or composition, with the plate such as is usually worn on boots or shoes, for the purpose of forming a foundation to the outer, or wearing, plate. Also in the method of holding the leather, or other material, which the outside plate is filled in with, by means of undercut edges in the recess on the outer or wearing plate."

A metal plate is to be screwed on to the heel in the usual way, and upon this a second plate is to be screwed by a single screw passing through the centre of each. The outer plate has an undercut depression for receiving a piece of leather, which covers the screw head. This outer plate may be removed when worn out. The claim is to the foregoing arrangement of the two plates.

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38. For *Dies for Stamping Polished Blanks, &c.;* William B. Dunbar, assigned to G. Herrick, Waterbury, New Haven county, Connecticut, October 31.

This die is for stamping buttons, or other articles; and the claim will afford a good general idea of the device which constitutes the subject of the patent.

"*Claim.*—What I claim is the mode of forming the figure in the face of the main dye, by types or movable sections of the figure, so dissected that each can be made and polished separately in all parts, and when united, or set in place, will, in connection with the face of the die, form the figure, and make the impression intended."

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39. For a *Rotary Hand Bellows*; Alexander Ewing, city of New York, October 31.

This hand bellows consists of a rotary fan wheel of the ordinary construction, contained within a circular case, or drum, and made to revolve by means of a winch. All this is sufficiently old, and would not be the subject of a valid claim; that made is to "the arrangement of the circular case containing the gearing, in combination with the fan bellows for increasing the velocity of the same." In this gearing there is but little novelty, and we apprehend that the whole superstructure rests upon an insecure basis.

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40. For a *Printing Press*; Lemuel Kingsley, city of New York, October 31.

"The nature of my invention consists in providing a set of changing motion, or self adjusting and self gearing friskets, and a mode, or modes, of using them, as well as by the arrangement and construction of the friskets themselves with the toothed rack and friction wheel, as the moving them in grooves on projecting or side railways; the changing motions being produced by the frisket rack gearing with, at proper times, the sector wheel and the toothed wheel, at the top of the press. Also the raising of the friskets from the lower to the upper horizontal railway, by the elevators, by the various operations of which the friskets are so moved as to replace one in the last position of the other, alternately."

This press, from the necessary complexity of its parts, is described in a specification of much length, in which numerous references are made to the drawings. It is a "bed and platten power printing press," and in its general construction bears a resemblance to that patented by Otis Tuffts, of Boston.

The claims are to "the method of circulating the friskets over the platten, and back under the same, by making two level railways one above and the other below the platten; with an inclined railway at one end, connecting them; the whole having grooves for the friskets to move in; and in conducting the friskets over the same by means of the pinion and toothed sector acting on the rack attached to said friskets; and also in combination therewith, and as necessary to the circulation of the friskets, the mode of raising the same from one level to the other by means of the elevators, the whole being constructed and operating as described."

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41. For *Ovens for Stoves:* Linus North, Palmyra, Wayne county, New York, October 31.

Claim. "What I claim is the employment of fire breakers located in the flue, under, over, and around, the oven of a stove, by which the flame and hot air are broken and spread, and the heat more equally diffused through all parts of the oven, in the manner described."

42. For a *Combination Furnace:* Augustus Roth, Pottsville, Schuylkill county, Pennsylvania, October 31.

A series of smelting furnaces are built in one stack, and lead into one horizontal flue. Each furnace has two boshes, one above the other, to prevent the too rapid descent of the charge. A steam boiler is to be placed in the horizontal flue, for creating, by the waste heat of the furnace, steam sufficient to work an engine for making the blast. The pipes for heating the blast pass through the horizontal flue.

The claims are, 1st. "The arrangement of fire chambers or boshes, opening into one horizontal flue above, in combination with the boiler for generating steam, and the pipes for heating the blast, placed in said flue; the whole being constructed and operating as described. 2nd. The method of constructing the fire chambers, by contracting them at the centre, and forming two boshes in each chamber, for causing the charge to descend gradually, so as not to obstruct the draught, and prevent the ascent of the lighter substances."

Specifications of American Patents.

Specification of a Patent for a Black Pigment. Granted to Nathaniel Chater, of the city of New York, October 5th, 1839.

Be it known that I, Nathaniel Chater, of the city of New York, have invented a new pigment which I call *patent black*; and I do hereby declare that the following is a full and exact description thereof.

It is intended as a substitute for ivory black, and answers every purpose for which that article can be employed, but is more brilliant in its hue, and infinitely cheaper. It is made from anthracite coal, and may be reduced to powder either in its dry state, in oil, or in water, in any description of mill. The method which I use to prepare the same is to grind it in water in either horizontal or edge stone mills, and to float it off into vats or pits, similar to the grinding of whiting, from which it is taken when it has subsided, and is dried for use. It may then be used for the making of black paint, printers' ink, blacking, or for any other purpose for which either ivory or lamp black is now used.

What I claim as my invention, and desire to secure by letters patent, is the manufacturing of a black pigment from anthracite coal, in the manner herein set forth, or in any other substantially the same.

Nathaniel Chater.

Specification of a Patent for an improvement in Circular Saws. Granted to Jonathan Gove, of Fayetteville, in the county of Cumberland, and State of North Carolina, October 16th, 1839.

In the use of the common circular saw a great evil is experienced from the unequal expansion of the metal, arising from unequal friction, and consequent heat, in sawing substances of less thickness or diameter than the semi-diameter of the saw, which causes the saw to buckle, and wabble, and perform its work very imperfectly; the friction and heat being around the periphery of the saw which enters the substance to be cut, whilst there is none around the centre part which does not enter it.

To remedy this evil, I construct the circular saw with springs extending from the periphery towards the centre, a sufficient distance, but not so far as the centre, and between the teeth, whether of the bill hook shape, or of the common form.

I do not claim the making circular saws in segments, as that is not new, but I do claim as my invention, and desire to secure by letters patent, the forming openings in the disk of a circular saw, extending from the periphery towards the centre, in the manner, and for the purpose described.

JONATHAN GOVE.

Specification of the Patent granted to JOHN DANFORTH GREENWOOD, *and* RICHARD WYNN KEENE, *of the county of Surrey, England, for an Improvement in the Manufacture of white Cement, or artificial stone, and in the application of Cement, and other earthy Substances, to the purpose of producing Ornamental Surfaces, October 9th,* 1839.

Our invention relates, first, to a mode of producing cement from gypsum, or sulphate of lime, or other calcareous substances; and,

Secondly, to a mode of producing inlaid patterns of such and other cements, or earthy substances. And in order that our invention may be fully understood, and readily carried into effect, we will describe the means pursued by us, which we have found fully to answer.

To make a White Cement of good quality.

We take any quantity of gypsum, or sulphate of lime, in lumps, as quarried, which is to be deprived of its waters of crystalization by heat, in a similar manner to that employed in the manufacture of plaster-of-Paris of commerce, as is well understood. Into a large tank, according to the quantity of gypsum, place a number of gallons of water, having dissolved therein one pound of alum of commerce for each gallon of water, into which the gypsum above-mentioned is placed, and allowed to remain, until it has taken up as much as possible of the liquid. The stone thus saturated, is then to be removed from the said liquid, and suffered to dry in the air, and is afterwards calcined in an oven, furnace, or kiln, at a low red heat, visible by daylight, in order permanently to fix the alum. The product is next to be ground to a powder, and, if necessary, sifted for use. When a white cement of greater purity is required for particular purposes, we select the cleanest and best quality of gysum, or sulphate of lime, and for a solution, in place of the alum of commerce before-mentioned, we substitute either the clarified or concentrated aluminous mother-liquor (as obtained from the alum works) of the required strength, and which, owing to the absence of alkali and other extraneous matter, more effectually answers the purpose of our invention.

For a Coloured Cement.

We dissolve half a pound of alum of commerce, with one quarter of a pound of copperas or sulphate of iron, in each gallon of water, and at this rate for any number of gallons of liquid that may be required, and excepting the components of this liquid mixture, the process of manufacturing the coloured cement is to be the same as previously described for the white

cement, and the result will be a pale red cement. And further, other gypseous or calcareous substances may be calcined in combination with alum, and with one or more of the sulphates, or other salts of earths or minerals, together or separately so as to form other cements of different colours and strengths. It should be observed, that in the calcining of the mixtures, heat is not to be continued so as to produce a smell of sulphur, but a workman after a little practice, will soon become fully acquainted with the process. And also, as the gypsum and other calcareous earths vary in their strengths, it is desirable, on commencing, to work with a fresh quantity of any of such substances, to test them by making small samples with different quantities or strengths of alum, or salts of other earths, or metals, in order to ascertain the best proportions for the cement required. In using cements of the above description, first as a stucco for buildings generally, either internally or externally, it is used in the same manner as any other cement or plaster now in use. Should a grit be required, we prefer the scoria or slag of iron, or other vitrified mass, reduced by pounding or other means, to a sharp grit, and use it merely in sufficient quantity to cause the cement to work freely. Where the surface is required to be polished, the last coat is to be of the cement alone, and in most instances the polish given by troweling is sufficient, but a superior surface is obtained by pursuing the methods used in polishing scagliola.

We will now describe the second part of our invention for applying the above cement for producing surfaces with inlaid patterns. We take tempered clay, wax, or other suitable material, which we beat out to the thickness of the intended inlaying, and place it on a smooth surface of slate, glass, marble, or other fit material. We then trace upon it, or transfer to its surface, from paper, the intended pattern, and afterwards cut out the pattern so transferred, slightly beveling or sloping the cut edges. It is now ready for casting in plaster, wax, or sulphur. On the cast thus obtained, having first slightly greased or soaped its surface, the cement, mixed with water to a proper consistence, is closely rubbed on, and in about twenty-four hours is sufficiently hard to come off, having the pattern depressed upon it which is then filled up with cement of any colour required. When dry, the whole is rubbed down to a surface and polished by any of the usual methods. The same method is also applicable to the production of inlaid surfaces in terracotta or pottery of all kinds.

Having thus described the nature of our invention, we would remark, that although we have described the best means of carrying out the same, we do not confine ourselves to the precise methods or quantities explained, provided the principle of our invention be retained; and the cement may be mixed with other materials than those above named, our invention not relating to the mode of mixing and using the cement when made, but consists in the mode of making the cement itself. But we would have it understood that what we claim as the first part of our invention is the mode of making cement from gypsum, or sulphate of lime, or other calcareous earths, by calcining them in combination with alum, or other earthy or metallic salts, as above explained. And

Secondly, we claim the mode herein described of producing ornamental inlaid surfaces.

John Danforth Greenwood,
Richard Wynn Keene.

Specification of a Patent for an improvement in the process of protecting articles of Iron and Steel from oxidation. Granted to PALMER SUMNER *and* PETER NAYLOR, *October 18th,* 1839.

To all whom it may concern: Be it known that we, Palmer Sumner, and Peter Naylor, of the city of New York, have invented an improvement in the "process, method, or methods, by which various articles of iron, or steel, may be preserved from oxidation, or rusting, by the galvanic action produced by zinc," for which process letters patent of the United States were granted to M. Sorel, on the seventh day of December, 1837; and we do hereby declare that the following is a full and exact description of our improvement.

We, the said Palmer Sumner and Peter Naylor, having become proprietors, by assignment, of a right to use the said process, have, in carrying the same into practical operation, found that the malleability of sheet iron is much impaired by giving thereto a coating of zinc, in the manner directed in the specification of the letters patent of the said M. Sorel; and that, in consequence of this diminished malleability, such prepared sheet iron is unsuited, in many cases, to be applied to the purpose of covering the roofs of houses, or to be otherwise used where it is required to be grooved, seamed, or in any way suddenly bent; and our improvement consists in a process by which this difficulty is obviated, whilst the zinc is at the same time so applied as by its galvanic action on the iron, to protect it from oxidation.

We take sheets of iron, and cover them with tin, or with an alloy of tin and lead, adopting in this process the mode, or modes, followed in the well known manufacture of sheets, or plates, of iron into tin plate. After having completed this operation, we submit the sheets, or plates, so prepared, to a like process, with the substitution of zinc for tin, or an alloy of tin; the mode of performing which process is fully set forth in the letters patent granted to said M. Sorel, and does not differ from the ordinary process known under the name of tinning. When thus treated, the plates, or sheets, of iron preserve their malleability unimpaired, and may be bent and otherwise worked as easily as before they had received such coating; a result which appears to be due to the interposition of the coating of tin between the zinc and the iron, by which interposition the chemical combination of the iron and zinc is prevented. Where it is not necessary to use plates of metal of a larger size than that of sheets of tin plate, we take that material as it comes from the manufactories, and have then only to give to it a coating of zinc, to receive which it does not require any particular preparation.

In the letters patent granted to M. Sorel, it is proposed, sometimes, to add a coating of tin *over* that of the zinc, for the purpose of giving to the article made, a brighter appearance, and as an improvement also in culinary vessels; but our process is the reverse of this, and the end attained by us altogether different from that above proposed, and, at the same time, our process produces a new and useful result.

What we claim, therefore, as our invention, and as an improvement on the process of M. Sorel, is the preserving the malleability of sheet iron, whilst it is protected from oxidation by the galvanic action between it and the zinc, in the manner above set forth, namely, by first tinning said iron in the ordinary way, and afterwards by giving thereto a coating of zinc above the tin.

PALMER SUMNER,
PETER NAYLOR.

Specifications of English Patents.

Specification of a Patent granted to William Bates, *of Leicester, fuller and dresser, for his invention of improvements in the process of finishing Hosiery and other looped fabrics.*—[Sealed 4th June, 1839.]

The patentee states:—My invention relates to certain modes of finishing hosiery and other looped fabrics, known by the names of lamb's wool, worsted, Angola, and cotton, by the means herein mentioned and explained.

According to the ordinary process pursued previous to my former patent, Angola and cotton goods were finished by being submitted to a process of ironing by hand; lamb's wool goods were not usually either ironed or pressed, but if occasionally they were pressed, it was without having legs or shapes inserted in them; worsted goods were usually pressed, but not upon legs or shapes; and rough or undressed goods were generally merely put upon legs, and exposed to heat by means of a stove, to give them size and shape. And in my former patent I did describe a certain mode of finishing goods made of elastic stocking fabric, and known by the name of lamb's wool, worsted, and Angola, by placing within them legs or other shapes, according to the nature of the articles to be operated on, and in that state submitting the fabric to the hot pressure of any suitable surfaces, produced by the heat of fluids; and I have since discovered that pressure, under such circumstances, that is, having shapes or forms inserted into the articles to be pressed, is beneficial, even though the surfaces are not heated; and one part of my present invention relates to the pressing such Angola, cotton, worsted, and lamb's wool knit or looped fabrics, with suitable shapes or forms within them, and whether rough or dressed, by the aid of flat or other pressing surfaces, worked by screw or other presses; and in performing this part of my invention, supposing the articles to be finished, according to this part of my invention, to be stockings, each stocking has a thin flat leg, or shape of wood, or other suitable material, inserted into such stocking; in this state they are to be submitted to pressure, in a similar manner to that described in my former patent; but the operation takes longer time, that is, from ten to fifteen minutes, or more; and in case rollers be used as the press, then it is desirable to pass the articles through several times, or by a very slow movement.

At the same time I would remark, that I do not consider rollers so good a description of press as the various kinds of presses having flat surfaces. I have mentioned stockings as the articles to be treated or finished. I would however, remark, that the same description applies to other articles; and the only difference is the flat shapes or forms of wood, or other suitable material, put into the article to be treated or finished, according to this part of my invention; by this mode of working, I dispense with the application of heat.

Another part of my invention relates to the application of heated shapes, legs, or forms, in the finishing of stockings or other knit or looped goods of lamb's wool, worsted, Angola, or cotton, and subjecting such stockings, or other knit or looped goods of lamb's wool, worsted, Angola, or cotton, to pressure whilst they are inserted on such heated shapes, legs, or forms; and the same is performed by heating the flat legs, or other forms or shapes, before inserting them into the stockings or other articles to be finished by this process, and such heating may be performed in any suitable manner.

I have found, that any degree of heat which will not burn or cockle the

articles under operation, quickens and improves the process of pressure when using legs, forms, or shapes, within the articles operated on; and the best means I am acquainted with for heating the legs, shapes, or forms, consists of an oven or such like vessel, heated by means of steam of fifteen to twenty pounds on the square inch, though other apparatus or means may be resorted to.

My invention not relating to the modes of heating the legs, forms, or shapes, inserted into the knit or looped articles of lamb's wool, worsted, Angola, or cotton, but to the application of such heated shapes, legs, or forms, in the finishing of such descriptions of goods; and having inserted such heated legs, forms, or shapes, into the goods to be pressed, I place them between two surfaces of a press; and I prefer placing them in single layers, using, by preference, the flat surfaced presses; and where more than one layer is placed in a press at one time, it is desirable to place, between each layer, a smooth sheet of millboard, or other suitable material, in order to keep the layers separate; and in case no such millboard or other material be placed between the layers, then it is desirable to have the goods placed on the legs, forms, or shapes, with the outside towards the legs, forms, or shapes, particularly where great pressure is required; and by this means, and submitting the goods to pressure, as above described, for from three to ten minutes, according to the extent of finish desired, a very beneficial operation of finishing will be obtained.

Another part of my invention relates to other means of applying heat in the process of finishing knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, when the articles are placed on legs, forms, or shapes; and consists of employing heated surfaces produced by the heat of fire or flame, or by heating surfaces with fluids, without such fluid being in contact therewith, or contained therein; and in place of employing heated surfaces containing hot fluids, as was the case in my former patent; and in order to give the best information in my power as to this part of my invention, I will proceed to describe the means pursued by me, and which I believe will be found, in practice, the best for performing this part of my invention. And I would first remark, that the legs, shapes, or forms, inserted into the goods, may be heated or not when performing this part of my invention; and I perfer, that in place of heating the surfaces of the press itself, to employ flat plates of copper or iron, or other suitable material; and in case of iron, I put sheets of millboard between the goods and iron plates, which, being heated, are to have a layer of the goods, with legs, shapes, or forms, inserted therein, as above explained. And I prefer having the goods in single layers, placed between two such plates, and then the plates and the goods between them placed in any suitable press, preferring those with flat surfaces, and thus submitted to pressure from three to five minutes; and it should be stated that, in heating such plates, care is to be observed not to heat them to such an extent as would burn or cockle, or otherwise injure the fabrics; and I usually employ iron ovens, heated by the direct action of fire, or the same may be heated with steam or other fluid. In case it be preferred to heat the surfaces of the press itself, this may be done by having suitable openings in such surfaces, to receive burning charcoal or hot irons, or gas, which, being previously heated, are to be placed in the hollow surfaces of the press; and in case rollers be used as the pressing means, then the same should be formed with suitable hollow axes to receive heated iron or gas, thereby to heat the pressing surfaces of the rollers; but, I would remark, in respect to this part of my invention, that I prefer to use plates separately heated by any convenient means, and to place between each two of them

a layer of the articles, having legs, shapes, or forms inserted therein, and submitting them, in that state, to the action of any suitable press or pressure; and I prefer placing millboard between the articles and the plates.

The object of the present invention being the employment of suitable heated surfaces, heated by any other means than hollow surfaces, heated by steam, hot water, or other fluids, when such employment of heated surfaces is combined with the employment of legs, shapes, or forms inserted in the articles undergoing the finishing process. It should be remarked, that in treating or finishing knit or looped Angola goods by hot pressure, it is desirable that they should be placed on legs, shapes, or forms, in a damp state.

Another part of my invention relates to submitting knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, when on legs, shapes, or forms, to the action of steam, whereby the character and appearance of such goods will be improved; and in order to perform this part of my invention, having placed a number of stockings on legs, or drawers, shirts, waistcoats, or other articles, on proper shapes or forms, I place them in a suitable chamber, which will contain steam; and I either suspend them in such chamber, or have a series of open shelves, on which the articles are laid; and I prefer placing them in single layers, and in this state allow them to remain, in what may be called a steam bath, for about three minutes, and then immediately press them whilst they are hot and damp from the action of the steam, or I permit them to dry on the legs, shapes, or forms, and in some cases without pressing them at all. The steam I use is five pounds pressure on the square inch; the chamber or bath being provided with an outlet to run off the condensed steam. The steam chamber I prefer to be quadrangular, sufficiently strong to resist the pressure employed; and having a door or opening readily removed, in order readily to place in and remove the goods, and yet sufficiently steam tight to waste but little steam.

Having thus described the nature of my invention, I would have it understood that what I claim is, first, the mode of finishing knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, when on shapes or forms, by means of pressure, without heat, as herein described; secondly, I claim the mode of finishing knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, by means of pressure, when on heated shapes, as above described; thirdly, I claim the mode of applying heated surfaces, in combination with the employment of legs, shapes, or forms, when such heat is obtained to the surfaces by any other means than by steam, hot water, or other fluids circulating in the hot pressing surfaces, as above described; and fourthly, I claim the mode of treating knit or looped fabrics of lamb's wool, worsted, Angola, and cotton, when on legs, shapes, or forms, by means of a steam bath, and either with or without pressure, as above described. Lond. Jour. Arts & Sci.

Specification of a Patent granted to James Drew, *of Manchester, in the county of Lancaster, Civil Engineer, for improvements in the means of Consuming Smoke and Economising Fuel in Steam Engine and other Furnaces, or Fire-places.*—[Sealed 8th November, 1838.]

These improvements in the means of consuming smoke and economising fuel in steam engines or other furnace, or fire-places, consists in providing the furnace or fire-place with a second or double set of fire bars, the one set or outermost of which are to be fixed to the boiler seating as in ordinary

furnaces, and the second or innermost set are to be fixed upon a carriage which shall be movable in a vertical direction, immediately behind the outer set of bars; and thus the improved furnace will be divided into two distinct parts or portions; the first or ordinary half, or any convenient part thereof, will support the fuel in the furnace, and the second or movable set be capable of being raised nearer to or further from the bottom of the boiler, as occasion may require.

The object of my invention being the more perfect consumption of smoke, and the consequent economy in fuel, is effected by such novel arrangement and construction of the furnace or fire-place, as the first or outermost set of fire-bars is intended to receive the fuel when it is firstly introduced into the furnace, and the charred or red hot coal is to be passed backwards, and thus placed upon the second or movable set of fire-bars, and immediately raised by the sliding carriage close under the bottom of the boiler, and placed nearer to or farther from the boiler, as the case may require, thus forming a narrow heated passage, causing the smoke to come in contact with the charred or red hot coal, the heat from which passes under the bottom of the boiler on its way to the flues, and as it rises from the green or fresh coal in the front part of the furnace, it will be perfectly consumed in passing over the second or red hot fire instead of being allowed to escape along with other gaseous products to the chimney, and thereby cause a considerable saving of fuel and heat, which is commonly lost. As the principal feature of novelty is so perfectly simple that it may be readily applied to any description of furnace or fire-place, I had scarcely deemed it necessary to represent its application to any one in particular, as it is evident that its adaptation to the various descriptions of furnaces must greatly depend upon the circumstances of the case; and also the mechanical arrangements, and other details, for raising or lowering the second or inner set of fire-bars, must entirely be at the option of the engineer.

It will readily be perceived that the mechanical agents or apparatus to be employed to carry my invention into practical effect, are capable of a variety of modifications, and however applied, will not in the least affect the result of the operation.

[A figure is given in the specification which we do not deem necessary to the understanding of the invention. The second set of fire-bars is placed so as to be easily brought, by screw or lever machinery, to a level with, or depressed below, or raised above, the common grate bars, so that the ignited and incandescent coals can be brought near the bottom of the boiler, and the throat or flue being thus constructed, the smoke and cinders of the fresh fuel have to pass over, and in contact with, the ignited coals.]

Having thus described the object of my improvements, and the manner in which the same may be carried into practical effect, I desire it to be understood, in conclusion, that I claim as my invention the elevation of the second set of fire-bars or back part of the furnace, either in a level or inclined position, and the lowering of the same in the manner and for the purposes above described, in whatever situation it may be used in connexion with ordinary furnaces or fire-places; and also by whatever ordinary mechanism or apparatus the same may be worked, as the lever, screw, rack, or any other well known agent may be effectively employed. Ibid.

Specification of a Patent granted to JOSEPH GIBBS, *of Kensington, Engineer, for an improvement or improvements in the Machinery for Preparing Fibrous Substances for Spinning, and in the mode of Spinning certain Fibrous Substances.*—[Sealed 21st December, 1839.]

This invention is described under three distinct heads; first, an arrangement of machinery for breaking the woody parts, or boom, from raw flax, New Zealand flax, and hemp, and partially separating the fibres. The material is fed into the machine through horizontal spouts or troughs, whence it passes between rollers, weighted, to produce pressure. These rollers have teeth or angular indentations all over their peripheries, in order that, as they revolve, they may pinch the material and crack the boom; and besides their rotary motions, the rollers have also lateral movements upon each other, which assist in breaking the boom, and thereby preparing the material for the subsequent operations of heckling and spinning.

The construction of the machine may be easily conceived. The rollers are all made to revolve by toothed gear upon their axles, driven by one actuating wheel and pinion, and the lateral movements are produced by excentrics upon the axle of the driving wheel, which cause the rollers severally to slide endways.

The feature of novelty claimed, is merely the particular arrangement of the parts shewn in the several figures of the drawing appended to the specification, constituting, as a whole, a machine for breaking and preparing flax, &c.

The second head of the invention, is the employment of a sort of scribbling engine for preparing floss silk. The silk is conducted, in an uniform thickness, from a feeding table, between rollers, to the cylinder or barrel, covered with fine pins, which, as it revolves, takes up the fine filaments of silk, and they are pressed in between the pins on to the surface of the barrel, as it goes round, by a cylindrical brush, which lies in contact with the barrel. When a sufficient quantity of the silk has been thus lapped on to the surface of the barrel, the operation is suspended, and the lap of silk so formed is then taken off in a sheet and placed in another machine, to be drawn and spun into threads or yarns; or the lap of silk may be separated in its width into several sliders, and passed immediately between drawing rollers to the spinning machine. In this part of the invention, the arrangement only of the whole machine is claimed as new, not the parts separately considered.

The third head of the invention, is the production of a peculiar sort of yarn, which is made by spinning or winding very fine fibres of cotton or other material, round a previously spun yarn of flax, or other fibrous thread. To effect this, any convenient construction of spinning or winding machinery may be employed, in which the previously spun yarn may be conducted from a bobbin, and brought under the operation of a winding flyer. The object of this winding is to give tenacity and strength to fibres of extremely delicate and fine materials. Ibid.

Specification of a Patent granted to JOHN SWINDELLS, *of Manchester, in the county of Lancaster, Manufacturing Chemist, for his invention of certain improvements in the Manufacture of Prussian Blue, Prussiate of Potash, and Prussiate of Soda.*—[Sealed 16th April, 1839.]

This invention of an improved method of manufacturing prussiate of potash, prussiate of Soda, and Prussian blue, consists in producing the same

during the process of manufacturing carbonate of potash, carbonate of soda, and British alkali, commonly called soda ash.

The common method pursued in manufacturing these articles, is by forming a mixture of the sulphate of potash, or sulphate of soda, lime, or carbonate of lime, and small coal or any other carbonaceous matter, and subjecting them to heat in a reverberatory furnace, and thereby decomposing the sulphates, and producing carbonate of potash or soda; and likewise a quantity of sulphuret of potassium or sodium, according to the article operated upon.

The patentee states, that "in my process I dispense with lime or carbonate of lime, and use, along with the various sulphates, a quantity of ground coal of the best caking description; and also a quantity of iron filings or borings, in manner following, namely:—I take any quantity of the sulphate of potash or sulphate of soda, and fuse them in a reverberatory furnace, such as is commonly used in the manufacture of alkalies; and then I add, by degrees, a mixture of small caking coal and iron filings, (in the proportion of one part of iron filings to eight of coal,) until I have added to the fused sulphate one half of their weight of coal, or more, if the sulphates require it, taking care to stir the materials well during the addition of the coal and iron filings, and also for ten or fifteen minutes after the whole of the coal is added, when the material will be ready to remove from the furnace, and allowed to cool.

I also produce the same results by mixing, in the first instance, the coal and iron filings with the various sulphates, and then fusing them in the furnace in the usual way; or the iron filings may be omitted in the process, but I prefer the addition thereof. The materials, after being cooled, I take and dissolve in water, and when the solution has subsided, I evaporate the same until it has obtained a specific gravity of 1.320, at a boiling heat; then I transfer it into coolers, when the prussiate of potash or prussiate of soda crystalizes in the course of four or five days; the solution now will consist of carbonate of potash or soda, and sulphuret of potassium or sodium, which sulphuret may be removed by the usual methods employed for that purpose.

The crystals of prussiate of potash, or prussiate of soda, will be required to be re-dissolved and re-crystalized, when they will be ready for use or sale; or they may be manufactured into Prussian blue, in the usual way. Ibid.

Progress of Practical and Theoretical Mechanics and Chemistry.

Anthracite Iron.

A series of experiments has been lately made of the quality of anthracite iron manufactured by the Ystal-y-fera Company, in the Swansea Valley. We are indebted to the gentleman (Mr. Richard Evans, of Manchester) under whose superintendence the tests were submitted, for a very detailed report of the results, which, we regret, from its length, we are unable to transfer to our columns. It will be our object, however, to render an abstract of the paper before us, which is in itself of too scientific and technical a character to be understood by our general readers. Mr. Evans having been requested to examine and report upon the strength of the several qualities—Nos. 1, 2, and 3—of the Ystal-y-fera iron, with a view to ascertain its properties, particularly in relation to other descriptions of iron,

proceeds in his report to give the results of about 280 experiments upon rectangular transverse bars, taking as the most satisfactory and methodical arrangement, that adopted by Messrs. Fairbairn and Hodgkinson, in the series of experiments reported in the "Sixth Report of the British Association." In effecting this, care was taken to follow closely the practical parts of the investigation of those gentlemen, by breaking the bars between supports of their distances—viz., of 4 ft. 6 in. and 2 ft. 3 in. apart. The trials were confined to the transverse strength of 1 in. rectangular bars, with their several values, as follow:—1, specific gravity; 2, modulus of elasticity; 3, transverse strength of 1 in. rectangular bars, 4 ft. 6 in. apart; 4, transverse strength of 1 in. ditto, 2 ft. 3 in. apart; 5, ultimate deflection; 6, power to resist impact, into which the tables are divided. The bars broken being from seventy-two specimens of No. 1—sixty-five of No. 2—and sixty-one specimens of No. 3—cast horizontally in sand, and melted by coke from the cupola in the ordinary way. In addition thereto were forty-four bars, being equal mixtures of Nos. 1, 2, and 3; twenty-four bars of the same quality, but planed down to a perfect 1 in. square gauge; and sixteen bars of the same mixture, but melted in the crucible. The several trials were effected with the greatest care, for which Mr. Evans expresses his obligations to Messrs. Whitworth and Co. (by whom the castings were furnished), and for the general interest and care manifested by those gentlemen to arrive at satisfactory results. It is unnecessary to enter into those details, suffice it to say, that they exhibit a proper regard on the part of Mr. Evans and others to give a correct result, and by the practical man will be duly appreciated. The first series of experiments made was on No. 1 Ystal-y-fera anthracite iron, with the view of ascertaining the transverse strength and elasticity of rectangular inch bars, to effect which seventy-two experiments were made at 4 ft. 6 in. and 2 ft. 3 in. distance between supports, as already mentioned.

We must necessarily confine our extracts from the report to the summary or abstract of the several experiments made, of which the following will be found to give the result—the numbers of the experiments referred to being explained in note at foot:—

Summary and comparison of the total mean results of the various tables, together with the same from Messrs. Fairbairn & Hodgkinson's list:—

	No. of experiments.	Specific gravity.	Elasticity in lbs. per square inch.	Breaking cwt., lbs. in bars 4ft. 6in.	Breaking cwt., lbs. in bars 2ft. 3in.	Ultimate deflectn. in parts of in.	Power to resist impact.
1*	72	7.093	13970644	444	445	1.843	821
2	65	7.120	14544293	494	499	1.632	811
3	61	7.130	16622197	531	537	1.640	916
4	41	7.110	15200982	465	479	1.553	749.7
5	16	7.190	14894800	551	597	1.625	901.2
6	24	7.110	14676771	533	539	2.447	1313.1

* In the tables, the figures used for reference are thus explained:—1. Mean of experiments on No. 1 Ystal-y-fera anthracite iron. 2. Ditto No. 2 iron. 3. Ditto on No. 3 iron. 4. Equal mixtures of Nos. 1, 2, and 3. 5. The same mixtures, but from the crucible. 6. Equal mixtures of Nos. 1, 2, and 3 iron, but planed bars. 7, 8, and 9, referring to the tables of Messrs. Fairbairn and Hodgkinson, being respectively, No. 1, No. 2, and No. 3 iron.

Forty-seven specimens from Messrs. Fairbairn and Hodgkinson's Tables of Nos. 1, 2, *and* 3, *as under:—*

7	10	7.032	14132994	433	428	1.597	694
8	25	7.029	14570118	435	443	1.626	711
9	12	7.122	17683712	478	487	1.374	685

Summary of the mean of the 198 *results of the three quantities of Anthracite, and the forty-seven from Messrs. Fairbairn and Hodgkinson's list:—*

198	7.114	15045711	489	493	1.705	849
47	7.060	15462274	418	452	1.532	696

In making a comparison of the same numbers of the anthracite iron, and those which are comprised in the latter forty-seven results, the first three of the six only, contained in the preceding table, must be taken, the other specimens being on iron, under other conditions, containing the mixed, planed, and crucible results, &c.

The last summary, if taken singly, or collectively, shows a superior value in every column in favour of anthracite iron as compared with the most numerous list of other makes; and it would appear that the No. 1 is the most uniform in texture, strength, &c., having the greatest fluidity, softest, and lowest specific gravity, and for its strength, which is the weakest, is most to be relied upon, as far as it extends.

The No. 2, less uniform, a little, in texture, and strength, fluidity, &c., but of higher specific gravity, and stronger than No. 1.

The No. 3 still less to be depended upon in the above qualities, but of increased specific gravity and strength to the No. 2.

The equal mixtures show a deterioration of the several Nos., compared to their values separately, and the same as regards specific gravity. The same, but cast from a crucible, exhibit an improved list of values, including a greater specific gravity.

The planed bars show an increased strength above the same metal in the black bar; this is the only specimen whose strength is increased, without the specific gravity being greater also, which must be due to the planing, and not to any alteration of metal, &c.

It may be inferred from the whole of the tables, except the last, that the higher specific gravity exhibited by the iron, the greater the strength.

The following observations are appended to the table of experiments with No. 1 iron, of which we have given the results in the preceding tables:—

The specific gravity of No. 1 iron at 7.093, is rather under the standard 7.207, as given by Tredgold, but above the mean of the No. 1 in Messrs. Fairbairn and Hodgkinson's list, which give 7.032 for twelve different irons of this number. As Tredgold's is a general one, and not the result of any particular number, and as it will be found in anthracite iron, as well as in Messrs. F. and H.'s results, that the No. 1 is usually a lighter iron than either of the Nos., the above may be considered a near approximation to the usual irons of the same No. or quality made from coke.

Its modulus of elasticity, the mean of which is 13970644, shows the comparative stiffness of the metal, and is given in pounds per square inch.

The breaking weights are given in three separate tables, the mean of which makes 444 lbs., 445 lbs., and 444.5 lbs. respectively, which approximate in rather a singular manner to each other, and must be taken as the

best proof of the uniformity of strength and texture of this number, the value of which, as compared with other irons, stand as under:—

Mean of 72 results, upon the Ystal-y-fera anthracite iron, No. 1 444 lbs.
Ditto of 10 different sorts of No. 1, in Messrs. Fairbairn & Hodgkinson's list, ... 430 lbs.

being a superior strength in favour of the anthracite iron of about $3\frac{3}{4}$ per cent. I regret that most of the other authorities give the breaking of 1 in. bars on a very limited scale, in few instances distinguishing the different Nos. they were made from, and broken between distances of every variety, which is an additional objection to my offering them in the above comparison; but in a summary of a few that I found most easy to reduce, they form rather an inferior value to Messrs. Fairbairn and Hodgkinson's irons.

This number, in internal structure, appears to bear out the uniformity just noticed, by its regular, dark gray appearance at the fracture, with an appearance of soundness and great smoothness in the pig and castings; when broken, the pig does not ring, but sounds rather like lead; it is also so soft as to yield readily to the chisel. In addition to the uniformity of strength just noticed, and that it is particularly sound, and free from air holes or defects in casting, may be inferred from the fact, that it did not produce one waster from any defect at the fracture, in the seventy-two trials; and if it is from excess of carbon that iron acquires the several qualities of uniformity, fluidity, smoothness in the castings, &c., this metal must be highly charged with it. In ultimate deflection and power of resisting impact, it also maintains its superiority at 1.843 and 821, the mean of the ten before-mentioned irons giving 1.597 and 694.

From the improvement the above iron appears to impart, by mixing with inferior irons, of which I have on record, from my engineering friends, several practical examples, I have no hesitation in saying it will come extensively into use for this application alone.

We regret we have not space for the observations which accompany each series of experiments, but the preceding remarks will give some idea of the views entertained by Mr. Evans, and the mode adopted by that gentleman.

Such is the substance of the report before us, and which we are glad to have the opportunity of submitting to our readers who are interested in the subject of the properties and application of anthracite. Mining Jour.

Smith's Patent Wire Rope.

Having already noticed this material, and adverted to the economy arising from its application, as regards its weight, size, and durability, we are glad to have it in our power to report the result of a series of experiments, which took place by order of the Lords of the Admiralty, at her Majesty's Dock-yard, Woolwich, on the 20th inst., under the immediate inspection of W. Tinmouth, Esq., at which we were present.

Considerable interest had been excited with reference to the test, the several specimens of hempen rope having been carefully selected, or rather prepared, for the experiment, so that a trial was made, not only of wire but hemp, the results of which are very interesting, and would have been much more so had the series of experiments been perfect. However, the results, so far as were arrived at, were of a satisfactory nature, as will be seen by the subjoined report, which we compared with the Government authorities.

The following are the results of a trial made with hempen rope:—

Size of rope. Inch.	Length of rope. Ft. in.	Weight per fathom. Lb. oz.	Broke at a strain of Ton cwt.	Stretched before breaking. Inch.
3	9 7	2 1	2 10	18
4¼	7 6	4 2	4 0	15
6	6 4	7 3	8 5	10
8	5 2	13 12½	20 15	7¾
10	6 3	21 6	32 10	6½
12	6 1	29 6	— —	—

The following are the results of the patent wire rope:—

1	13 4	1 0	3 0	1½
1⅛	13 2	2 7½	5 10	1⅛
1⅞	13 5	3 1	6 15	1½
2¾	13 6	7 4	14 0	1
3⅝	13 9	9 11	17 5	1
4⅜	13 6	18 9	— —	—

From the preceding statement, it will be seen that, in the two first of the series of experiments, the comparative weight and strength of the materials were—

3 inch hemp rope, weighing 2 lbs. 1 oz., broke at a strain of 2 tons 10 cwt.
1 inch wire rope, weighing 1 0 ditto 3 0

It will thus be seen, that the wire rope of one-third the circumference, and with one-half the weight of the hempen rope, was capable of bearing an additional strain of 20 per cent.

In the second experiment—

4½ inch hemp rope, weighing 4 lbs. 2 oz., broke at a strain of 4 tons 0 cwt.
1⅝ inch wire rope, weighing 2 7½ ditto 5 10

Here, again, we find that a wire rope of about one-third the circumference, sustained a strain of nearly 40 per cent. beyond that of the hempen rope. And here we may remark, with respect to these tests, on the difference observable in the two materials as to the "stretching" before they broke, in the instance of the 3-inch hemp which broke at a strain of 2 tons 10 cwt., we find that it stretched or extended 18 inches on a 9ft. 7 in. length, while with wire rope of 1 inch, which broke at 3 tons, the stretch on a length of 13 ft. 4 in. was only 1½ inch, or about one-eighteenth part of that of hemp.

With reference to the other tests, we consider it would be unfair on both sides to draw any deductions. As regards the hemp rope, the "seizings" were in several instances obliged to be restored, and the trial could hardly be said to be fair, while in the case of the 12 inch rope, it was withdrawn, to be subjected to another trial, the "seizing" having slipped before the strength could be ascertained. A similar defect on the part of the patentee was also observable as respects the splicing of the wire rope, the "splice" having given way in the last four experiments, although, we believe, that the main defect was in the "thimble" around which the rope passed not being sufficiently large, or of a concave form, to take the wires, and which not being "served," spread over the sides of the "thimble," and consequently, allowing the strain to be imperfectly applied. This was so manifest to all present that the authorities under whom the experiments were made, at once expressed their willingness to submit the rope to a further

test, which will, we understand be made next week. Under such circumstances, we do not feel it right to make any remarks. As a proof of the strength of the wire rope, we may observe, that in trying the strength of a 4⅜ inch rope, one of the "shackles" employed, made of best 1½ in. iron, or 4½ inch diameter, snapped, when the strain was 23¼ tons—we are happy to say without any injury. This rendered the experiment nugatory, as will be observed above.

We feel it a duty to acknowledge the kindness and urbanity of Mr. Tinmouth, and the fairness and liberality evinced on the part of the authorities, and on that of the patentee, throughout the trial; it was pleasing to see a desire evinced on both sides to arrive at correct results, without the slightest prejudice being allowed to manifest itself.

Captain Routh (the managing director of the London and Blackwall Railway,) Mr. Maudsley (the engineer), Mr. Newton (the patent agent), Mr. Turnbull (Her Majesty's consul for Havanna), and several naval officers, with the Government authorities, and other gentlemen connected with science, were present during the trial, which lasted for upwards of four hours. Ibid.

Mr. Spencer *on Further Improvements in the Voltaic Process of Multiplying Works of Art in Metal.*

To the Editor of the Athenæum.

Sir—I take this opportunity of laying before yourself and readers a brief detail of a still further improvement of my voltaic process of multiplying works of art in metal. In my pamphlet, printed last September (*Athen.* No. 626,) I there stated that I considered the process comparatively incomplete, unless we were able to apply it to the multiplication of models in clay or wood, castings in plaster, wood engravings, &c., as the fact, that galvanic deposition always requires a metallic surface to act on, seemed to set bounds to these branches of its application. I then resorted to various expedients to surmount the difficulty,—among others, that of gilding and bronzing the surfaces of such materials to a limited extent; this was successful, but still troublesome and expensive, and, more than all, the sharpness and beauty of the original was necessarily injured. I have since attempted to metallize surfaces by the use of plumbago, (suggested to me many months ago by Mr. Parry, of Manchester.) This last possesses some of the faults common to the others in a greater degree, and in some instances the deposition goes on partially.

I am happy, however, to inform you, I have now adopted a method which answers completely, obviating all these objections, and leaving the surface of the material to be acted on as sharp as it was previous to the operation.

Should I be desirous of obtaining a copper mould or cast from a piece of wood, plaster, or clay, or, indeed, any non-metallic material, I proceed as follows:—Suppose it is an engraved wooden block, and I am desirous of metallizing it, in order that I may be able to deposit copper on its surface, (this example will hold good for any other material,) the first operation is to take strong alcohol, in a corked glass vessel, and add to it a piece of phosphorus (a common phial corked will answer the purpose); the vessel must now be placed in hot water for a few minutes, and occasionally shaken. By this means the alcohol will take up about a 300th of its bulk of phospho-

rus, and we thus obtain what I would term an alcoholic solution of phosphorus. The next operation is to procure a *weak* solution of nitrate of silver, place it in a flat dish or saucer; the engraved face of the block must now be dipped in this solution, and let remain for a few seconds, to allow capillary action to draw it into the wood.

This operation being performed, a small portion of the alcoholic solution of phosphorus must now be poured in a capsule, or watch-glass, and this placed on a sand-bath, that it may be suffered to evaporate. The block must now be held with its surface over the vapour, and *an immediate* change takes place; the nitrate of silver becomes deoxidized, and gives place to a *metallic* phosphoret of silver, which allows the voltaic deposit to go on with as much rapidity and certainty as the purest silver or copper.

The whole process may be performed in a few minutes, and with absolute certainty of success. The interior or the exterior surface of a plaster or clay mould of a statue, no matter what size, may be thus metallized with equal facility. For the process of vaporizing, and should the material to be acted on not be very large, I prefer fastening it to the top of a bell glass receiver with a bit of pitch or cement, and thus placing it *over* the capsule on the sand-bath; the phosphoric vapour is by this means equally diffused, and not dissipated. An ethereal solution of phosphorus also answers; and a solution of either of the chlorides of gold or platinum may be used. I am inclined to think this process, independent of its uses in galvanic precipitation, may be applicable to other branches of art. I would recommend those curious of testing its effects, to try a small and sharp plaster of Paris medallion: dip its *surface* in a weak solution of nitrate of silver and *take it out immediately*, fasten it to the bottom of a glass tumbler, and at the same time have a little hot sand ready in a dish; lay the watch glass, containing a few drops of the phosphoric solution, on it; now place the mouth of the tumbler over all, and the medallion will be observed almost instantly to change colour. The operation is now completed. A piece of pottery ware in the state of biscuit may be acted on in a similar manner.

Liverpool, June 27. THOMAS SPENCER.

Athenæum.

HALL'S *Hydraulic Belt.*

This invention is simple, consisting, as it does, of an endless woollen belt, passing over two rollers—the one being fixed at the top of the shaft, and the other at a slight depth below the surface of the water, in the sump. By giving motion to the upper roller, whereby the belt acquires a velocity of 800 to 1000 feet per minute, the gravity of the water is overcome, and raised to the required elevation in a uniform and continuous discharge from the physical properties inherent on the principles of capillary attraction and centrifugal force.

We are given to understand that the cost of the belt, with all the machinery necessary to work it, will not exceed one-third of the expense incurred in the erection of the common pump, while the power acquired is said to be greater—at the same time, that it is not subject to the casualties incidental to the ordinary pump.

The rapid motion of the belt occasions it to act as a powerful ventilator, and therefore possesses a further claim to attention in connexion with some of its applications, to which we may hereafter direct attention.

Having seen the belt in operation at the Polytechnic Institution, where

a four inch band is employed in raising water twenty feet high, with a copious discharge, we availed ourselves of the opportunity afforded us, by an invitation from Mr. Hall, the patentee, to inspect the belt in action, on a more extended scale, at Portman Market, where, accompanied by a scientific friend, we made our observations, and which we now present to our readers.

The mean depth of the shaft, or pit, from which the water is raised, is 134 feet, and the power employed is that of a steam engine, of eight inch cylinder, with a seventeen inch stroke, working at twenty-two pounds on the inch; this being attached to the upper roller, as already described, works a band of four and three-quarters inches width, traveling, as we were informed, at the rate of 1000 feet a minute, but which we did not prove, our attention being more immediately directed to the quantity of water raised in a given time. That our readers may follow us, we will at once proceed to describe the apparatus employed, and the measures we adopted to arrive at the result, which, however, in the course of the ensuing week, we purpose again testing; the conclusions at which we arrive not being in accordance with those previously obtained by other parties, possibly arising from circumstances which may be explained, and the trial in our case being made in the absence of the patentee.

As we have already observed, the motive power is attached to the upper roller, or drum, over which the belt runs, communicating with the lower roller, which is placed in the sump, or water pit, and thus forming an endless band. The rollers being in action, the belt travels, carrying with it a face or band of water, which, having reached the summit, discharges itself into a vat of the dimensions of six feet by seven feet ten inches—each inch in depth, with such superfice, being estimated as containing $24\frac{1}{2}$ gallons, the weight being determined by Mr. Donkin, by experiment, as $245\frac{6}{10}$lbs. During the experiment made, of four minutes, the quantity of water discharged into the vat was equal to $4\frac{11}{16}$ inches—the last minute giving $1\frac{3}{16}$ inch, the engine working fifty-six strokes per minute. Mining Jour.

Wire Rope for Mining Purposes.

Some years have elapsed since the introduction of the wire rope, to which, we believe, we first directed attention in this country. M. Albert, of Clausthal, having communicated to Dr. Karsten the result of experiments made, in 1834, by him in the mining district of the Upper Harz; the importance of which may be gathered from the fact, that the estimated quantity of new rope required annually is 38,500 feet. A patent, it appears, has been taken out in this country for the manufacture of wire rope, by Mr. Smith, of Poplar, and having had an opportunity of seeing the various descriptions of rope manufactured under the patent, we are induced to direct the attention of our readers to an invention which promises to be most useful, and, in many respects, invaluable.

The patent consists of improved methods of preventing oxidation, and combining wires in a manner so as to render them more flexible than any hemp rope of the same strength; and experiments having been made in her Majesty's Dock-yard at Woolwich, by order of the Lord Commissioners of the Admiralty, it is proved that a two inch patent wire rope bore half a ton more strain than a seven inch hemp rope. With the object of introducing the wire rope for mining purposes, we may take, for instance, a hemp rope,

100 fathoms long, which we will assume as weighing 20 to 25 cwt., while a patent wire rope, of equal strength, is only one-third that weight, thereby making a considerable difference in the application of the two ropes, with reference to the power required; at the same time, it is estimated a saving in cost of 30 per cent. is effected.

If we take a six inch rope (hemp,) we find it will bear a strain of eight tons, its weight being about nine pounds per fathom. To obtain a wire rope capable of an equal tension or strain, it appears that one of two inch is adequate, the weight of which is only two pounds two ounces.

The importance and value to be attached to the wire rope is thus rendered manifest, as in our deep mines, of 250 to 300 fathoms, where we will, for argument sake, assume that a nine inch rope is used, we shall find that the dry rope would in itself weigh nearly six hundered weight, while, by the application of the wire rope, the size of the rope is reduced two-thirds—one of three inches being of equal strength, the weight of which would be less than one-fourth of that of hemp, or say one and a half hundred weight.

A series of experiments will have been made this week, the results of which we hope to note in our next number; in the *interim*, however, we may give those which have attended a trial made within the last few days, as to the comparative strength of iron, both as chain and rod, with that of wire rope, which are as follows:—

	Length. Feet.	Weight. Lbs.	Broke with a strain of Tons	cwt.	qrs.	lbs.
¾ inch chain	14	30	4	9	0	0
¾ inch rod-iron	14	10	4	4	2	12
¾ inch wire rope	14	6	7	6	0	20

We cannot, on the present occasion, enter further into detail, but purpose returning to the subject next week, giving the paper, by M. Albert, referred to, which will be found in the accompanying Number of the *Mining Review*.

Ibid.

Novel Railway.

Having, on a late visit to the Polytechnic Institution (which, we are happy to say, is making rapid strides in its advancement to public favour, from the numerous additions which have lately been made to its collections of models and inventions,) had an opportunity of examining two models of Mr. Rangeley's Rotation Railway—for such, we believe, is the title given to the patented invention of this gentleman—we propose briefly noticing it on the present occasion. It may be described in a few words, and as the model is upon a minute scale, without those appliances necessary for judging of its merits, or any advantages it may possess, when practically applied, we can only render to our readers a description, leaving it to those, who may consider it in a scientific point of view, to examine and judge for themselves, while to the public its novelty will at least claim attention, and doubtless, render it an object of attraction to those who frequent this institution. Opinions will, of course, vary, but one will be universal—the importance to be attached to the safety of life—and this, in a great measure, if not entirely, appears to be accomplished by the means projected by the patentee. The "Rotation Railway" consists of a series of wheels in lieu of parallel lines of rails, on which the carriages run—the latter having no wheels, but a plain surface,

which passes over the wheels, indeed, we can only compare it to a railway reversed, the wheels forming the railway, and railway plates being attached to the carriages instead of the wheels. It will, therefore, be understood, that the power employed is not, as in ordinary cases, to the carriages by way of locomotives, but is given to the wheels, the impetus once given to which, set in motion, carries forwards the carriages with a given velocity, which, however, we believe, is not yet determined. It is almost unnecessary to say, that the wheels (around the axles of which a rope passes) are worked by means of stationary engines, placed at contemplated distances of from three to twenty miles—the power for so great a distance being supplied on the pneumatic principle. The model, we have already observed, is upon too minute a scale, more especially in the absence of any calculations or estimates, to form a judgment. The carriages, from their construction, in a great degree, ensure safety from resting upon the wheels, by which about one-third is below the point of bearing. We think Mr. Rangely would do well to submit it to the opinion of scientific and experienced railway engineers, who should be requested to report upon it, and such report, with actual practical results, from experiments on a working scale, if submitted to the public, would, doubtless, effect the object Mr. R. has in view. The model conveys a correct idea of the principle, but its advantages or disadvantages, are by no means developed. We think it worth the attention of some of the companies, or a few individuals, to take up the invention, and test its merits. Mining Jour.

Improvements in Reducing Friction in Wheels of Carriages, which improvements are also applicable to bearings and journals of machinery, patented by Charles Greenway, of Douglas, in the Isle of Man, July 3.

The first claim consists in the method of forming a "cradle" for the reception of spheres or rollers near to which, the arm of the axle is made to rotate, whereby a considerable friction is overcome, as the spheres or rollers do not require an axis, and the cradle is so formed as to keep them close to the axle.—In the description of the second improvement, the inventor states that to the carriage, on which the trunnions of a caronnade are usually fixed, the wheels are not used, in order to prevent recoiling. But in his improvement, wheels are put to the carriage, so as to facilitate the movement of the caronnade towards the port-hole or embrasure; and before the act of firing, the caronnade with its trunnion is moved by the action of a lever from the carriage on to the deck of a vessel to prevent recoiling, and is again restored to the carriage by the same lever, when preparing to reload.—*Inventor's Advocate.* Civ. Eng. & Arch. Jour.

On the use of Mica as a substitute for Glass. *By* Joseph Glynn, F. R. S., M. Inst. C. E., &c.

In the windows of the workshops at the Butterley Iron Works so much glass was broken by the chippings of iron, that a substitute was sought which should resist a moderate blow, and yet be translucent. A quantity of sheets of mica were procured from Calcutta, which, when fixed into the cast-iron window frames, were found to resist the blow of a chipping of iron driven off by the chisel with such force as would have shivered a pane of glass.

Mica possesses both toughness and elasticity, and when a piece of iron does penetrate it, merely a hole is made large enough to allow the piece to pass, while the other parts remain uninjured. It is not quite so transparent as glass, but it is not so much less as to be objectionable; but this circumstance is not important at Butterley, as in consequence of the quantity of fluoric acid gas evolved from the fluate of lime used as a flux in the blast furnaces, the glass in the windows is speedily acted upon, and assumes the appearance of being ground. Mica is a little more expensive than common glass; but, as its duration promises to be much longer, it must be more economical; and if an extensive use of it could be induced, a more ready supply would be obtained—probably from Pennsylvania, or from Russia, where it is commonly used for windows in farm houses, and also on board ships of war, as it is less liable to be fractured by the concussion of the air during the discharge of heavy artillery. It can be procured of almost any dimensions necessary for ordinary purposes, as it has been found in Russia in masses of nearly three feet diameter. It is susceptible of very minute subdivisions, as, according to Haüy, it may be divided into plates no thicker than one three-hundred-thousandth part of an inch.—*Transactions of Civil Engineers.* Mining Jour.

Progress of Civil Engineering.

Light Houses.

Captain Basil Hall briefly explained his views as to obtaining for light-houses all the advantages of a fixed light, by means of refracting lenses in revolution.

The difference between a fixed and a revolving light is much in favour of the revolving light, as the light can be concentrated and great brilliancy obtained on any particular point at each succeeding flash;—by a fixed light, being meant, one in which the light is visible on every side; and by a revolving light, one in which the light appears in periodical flashes. Fresnel's fixed light has only one-sixth the brilliancy of his revolving light. Fresnel's system consists in having a large central lamp with four concentric wicks, surrounded by eight lenses, each three feet diameter. The light is thus concentrated and thrown off in eight pencils, which, as they strike the eye successively, have very brilliant effect, and are visible at a great distance.

Captain Basil Hall's inquiries have been directed to ascertain whether the well-known superior brilliancy of a revolving light could not be obtained for a fixed or continuous light; that is for one equally visible in all directions at the same moment. His idea was, that by giving a certain velocity of revolution to a series of lenses round a fixed light, as in Fresnel's arrangement, a continuity of illuminating power, equal almost in brilliancy to that of a slowly revolving light, might be produced. This he expected, would prove true, provided no intensity were then lost. He had erected some apparatus at the Tower, and determined the effect by experiment. The apparatus consisted of a fixed central light with a series of eight lenses, 1 foot diameter and 3 feet focal distance, so arranged as to revolve at any velocity up to 60 revolutions per minute. The light from the central lamp being concentrated by refraction through the eight lenses into eight pencils, having a divergence of about 8° each, illuminated not quite 50° of the hori-

zon when at rest; but when this same system of lenses was put into rapid motion, every degree of the 360° of the horizon became illumined, and to spectators placed all round the horizon, the light would appear continuous and equally brilliant in every direction. The only question would be, whether or not this continuous light is essentially less intense than the light seen through the lenses at intervals when in slow motion. The fact is, that two distinct effects are produced in this experiment—a physical effect in diminishing the brilliancy of the light exactly in proportion to the ratio of the dark portion of the horizon, compared to that of the enlightened portion, viz. as 310° to 50°; and a physiological effect, (suggested by Professor Wheatstone,) by which the sensibility of the retina might be so excited by a succession of bright flashes, that not only a continuity of light might be produced, but a light not much, if at all, inferior in intensity to that caused by the lenses at rest. When first set in motion, the effect is that of a series of brilliant but trembling flashes; as the system of lenses is accelerated in velocity, the steadiness of the light increases with scarcely any apparent diminution of brilliancy. At 44 revolutions per minute absolute continuity is produced, and at 60 revolutions nearly the steadiness of a fixed light. When viewed from the distance of half a mile, the effect is nearly that of continuity, very much resembling that of a fixed star of the first magnitude. The only difference in the quality of the light is, that the lenses being in motion, it resembles a star twinkling violently; and when at rest, it resembles a planet. The difference of intensity had been measured by examining the light through a number of plates of stained glass. Some eyes had seen the light through 13 glasses, the lenses being at rest, and through 12, the lenses being in motion; other eyes, with other glasses, had seen it through 10, the lenses being at rest, and 8, the lenses being in motion. He had seen it through 9, the lenses being in motion, and through ten at rest. He did not pretend to say whether mechanical difficulties might not prevent the adoption of the system; what he aimed at was to establish the principle, that by putting a system of lights into a rapid rotary motion, a continuous light, visible in all directions, would be the result, without any essential diminution of brilliancy, as compared to that of the same lights when viewed at rest. If this principle should prove correct, its application to practice might afterwards be thought of, and left to the ingenuity of the engineer; but if the principle should not be correct, and there was a great loss of light by the rotary motion, then it would be useless to go on.

Mr. Parkes observed, that he could entirely confirm the account of the experiments with revolving lenses given by Captain Basil Hall on a preceding evening. It appeared to him, that when the lenses made 32 revolutions, the light was not quite continuous; but at 40 revolutions it was perfectly so, although the general effect was twinkling. The central spot was very distinct; he saw the light equally as distinctly through 10 coloured glasses, the lenses being in motion, and through 11, the lenses being at rest. He would suggest, whether the tremulous appearance of the light might not be in part accounted for by the slightness of the revolving frame, which, at the required velocity vibrates considerably. In the temporary apparatus erected at the Tower, one man could maintain about 40 revolutions per minute.

Mr. Alexander Gordon remarked, the coincidence of the experiments of Captain Basil Hall, with a law of light as laid down by writers on optics,—viz., that if a luminous body pass the eye eight times in one second, the impressions are blended so as to produce the appearance of continuity, or

that the duration of an impression on the retina may be taken at about one eighth of a second. Now, in the apparatus erected by Captain Basil Hall, there are eight lenses, and continuity of light is produced when the frame makes 60 revolutions a minute. Thus, eight lenses flash across the eye in one second, and the observed result is a remarkable confirmation of the law alluded to.

Mr. Hawkins thought the light was better and steadier at 40 revolutions than at any other speed. When observing the reflection of the light on the features of the by-standers, he saw them very distinctly, the lenses being at rest; but from the moment of commencement of motion, there was a visible diminution in the intensity of the light, which increased with the speed. He saw the light, the lenses being at rest, through 10 coloured glasses, and through 9 when in motion.

Mr. Macneill thought the light was steadier at 60 than at 40 revolutions. The shadow was less intermittent. He did not conceive the mode of examining the intensity of the light through coloured glasses to be so correct as by observing the depth of the shadow, as the eye was capable of judging more correctly of the relative intensity of shadows than of lights. When the lenses were in rapid motion, there appeared a dark spot in the centre of a luminous disc.

Professor Keating, of Philadelphia, stated that the dark spot in the centre appeared as if he saw the wick of the lamp. The lenses being at rest, the light was uniform; but on their acquiring a certain degree of velocity, its whiteness diminished; until at 40 revolutions, a decided orange tint appeared, and at 60 revolutions both the orange hue and the centre dark spot increased.

Mr. Lowe inquired whether the quantity or intensity of light was most required for light-houses. The conflicting opinions of experimenters on the intensity of light, as ascertained by the photometers now in use, show that some better test or means of comparison is wanted. He should conceive that pieces of coloured glass could not afford any accurate measurement of the space-penetrating power of light at so small a distance as 345 feet, which he understood was the length of the room in which these experiments were tried. The depth of shadows also furnished no adequate measure of the intensity of light, for shadows were differently coloured for different lights. Perhaps the photogenic paper might furnish the tests and means of comparison now so much wanted.

The President remarked on the advantages of the revolving lights, as apart from the greater brilliancy, in that they are peculiarly useful as being easily distinguished from land and other lights, which tend to mislead mariners. There may be peculiar advantage in the tremulous character of Captain Basil Hall's light, as enabling it to be more easily distinguished among others. It is not simply the quantity of light which is diffused over the horizon which is valuable, but the intensity of the ray in a certain direction, which, falling on the eye, rivets immediate attention.

Lond. Jour. Arts and Sci.

Railway Telegraphs.

Mr. Saunders, the secretary of the Great Western Railway, states the expense of constructing the electrical telegraph on the line of that railway to have been from £250 to £300 a mile. This description of telegraph, however, when once constructed, is worked at a very trifling expense,

whereas the telegraph now in use between London and Portsmouth, independent of the original outlay, costs about £3,300 a year, and the lines of telegraphic communication to Plymouth, to Yarmouth, and to Deal, were abandoned in the year 1816, on account of the expenditure required for their maintenance.

Whenever a telegraph shall have been laid down between London and the other ports and mercantile cities of the island, it will give to its proprietors great advantages in obtaining and transmitting information, which must be attended with most important results. For the purposes of the railway itself, this telegraph may also be frequently used to prevent the risk of accidents and to obviate delay and inconvenience.

Your committee are of opinion that circumstances may arise in which it may be very inconvenient to leave in the hands of a private company, or possibly of an individual, the exclusive means of intelligence which this telegraph will afford; and it cannot fail to be of paramount importance that the government should be furnished with similar means of procuring and transmitting intelligence, and they believe that no Railway Company will object on fair terms to give every facility to the government for establishing a line of electrical communication over the whole length of their railway.

Your committee are aware that they have not fully developed the great and increasing importance of this subject, which perhaps does not fall strictly within the terms of the subject-matter referred to them, but they are most anxious to fix the attention of the House and of the public on a discovery which is no less susceptible of useful than of dangerous application.

Civ. Eng. and Arch. Jour.

New Railway Locomotive, invented and constructed by Mr. Walter Hancock, *of Stratford, Essex; now on trial on the Eastern Counties' Railway.*

One of the principal advantages of this locomotive is presented in the boiler, by which steam of greater power is generated with far greater certainty of continued supply, and more perfect safety, than by the boilers now in use, either in railway, marine, or stationary engines. This boiler is constructed of a number of distinct chambers, each chamber composed of several tubes. Each chamber, or rank of tubes, connects with two general cylinders, or reservoirs—one at the bottom for the supply of water, and the other at the top for the reception and passage of steam. The communications from each chamber to the water, steam pipes or reservoirs, have self-acting valves. When any leakage occurs, from wear, rents, or other causes, to any one chamber, the valves belonging to it close, and are kept to their seats by the pressure of the water and steam contained in the neighbouring sound chambers, and the boiler remains as effective as before, excepting that the surface of that one chamber, is thrown out of use, without stopping the engines, and perhaps it would not be observed by the engine driver until the end of the trip, when the pressure being reduced by withdrawing the fire, the valve would fall from its seat, and point out the defective chamber by the discharge of water. In half an hour a new chamber could be attached in its stead. In the ordinary locomotive boiler, when any of its tubes become defective, the whole is rendered inoperative by reason of the unchecked communication of all the parts with each other, and so it remains until the defective tube is repaired, replaced, or plugged, which generally occupies three or four hours, and is attended besides with the inconvenience of stopping the train until another engine is procured from the next station.

By adopting the improved boiler no such delay would occur, and the expense both in fuel and wages, of keeping a number of engines with their fires up ready to meet such casualties, would be avoided, as well as the risk when a train stops out of time, and having another train brought in collision with it, and the lives of passengers and attendants endangered.

The great heating surface obtained in a comparatively small space, is likewise a recommendation to this boiler. It is intended to attach a reciprocating set of fire bars to it, by which a clean floor of bars can be introduced without lowering the fire. The small weight of this boiler in comparison to its generating power, is another material point in its favour, for it leaves room for giving sufficient strength to all other parts, without exceeding the present total weight of a locomotive.

Having given a general description of the power—the engines and machinery come next under consideration.

The engines of the present locomotives are placed horizontally, and are thereby very much confined and difficult of access, but in this one they are vertical, and therefore the whole of the machinery, pumps, &c., are open to view, can be readily oiled, and speedily detached for repairs; or any portion may be put right and secured whilst the engines are working.

The engines of this locomotive give motion to a separate crank shaft, and this communicates the progressive motion to the wheel axle by an endless chain, working over a pulley fixed on each, and which two pulleys may be either of equal or different diameters, so that advantage may be obtained either for speed or power, whichever may be required. This arrangement not only allows the wheel axle to be straight instead of cranked, but it also possesses the advantages of a moderate accommodation or play, by which all sudden jerks or concussions of the machinery, &c., are avoided.

The friction is reduced to above one-half, from such large excentrics, crank-bearings, &c., not being required, in consequence of the weight of the machinery, boiler, &c., being on straight instead of cranked axles.

This arrangement allows the wheels to be immediately thrown out of gear, so that the engines will work the injection pumps, and get up the fire, without working the driving wheels. By running locomotives about, to effect these purposes, much of unnecessary wear and tear is incurred, besides running on the rails in the way of trains, &c. The present locomotive need not stir from the spot until the train is attached—the clutch then thrown in, it immediately starts upon its trip.—*Correspondent of the Railway Times.*

Ibid.

Improved Land Surveying Chain.

Sir—Observing in a former number of your Journal a description of an improved surveying pole, I venture to trouble you with an account of what I consider an improvement which I have lately made in the chain, namely, having the 11th, 21st, 31st, and 41st links made of brass, the rest being of iron; by this arrangement the brass link, being in all cases nearer the middle of the chain than the token, will at once point out whether such token be 10 or 90, 60 or 40, &c., and as a matter of course the liability to mistake 40 for 60, and so, entirely done away with. In mineral surveying a chain of this construction is incalculably superior to one of the old.

If you think the hint is likely to be useful to any of your readers, I shall feel obliged by your giving it a place in the Journal.

Barnsley, Aug. 3, 1840. William James Hindle.

Ibid.

To the Readers of the Journal.

The next number of this Journal will be the commencement of a NEW SERIES, and efforts have been made to improve both the intellectual and mechanical departments of the work. These arrangements will be announced in the January number. They will unavoidably produce a short delay in the publication of that number, but it is expected to be presented to subscribers soon after the middle of the month. The Professors of the Franklin Institute and other friends of Science have undertaken to aid the Committee in their proposed improvements, and an entire new fount of type will clothe these contributions in a suitable dress. The deductions from the experiments on Water Wheels will appear in the new series of the Journal, the first number being prepared for February next. COM. PUB.

Meteorological Observations for September, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	60	75	29.90	29.90	W.	Moderate.		Clear—do.
	2	60	80	.84	.84	N.W.	do.	.10	Clear—rain
☾	3	60	58	.80	.80	N.W.	do.		Cloudy—do.
	4	56	66	.96	.94	N.E.	do.		Clear—cloudy.
	5	58	58	.90	.90	N.E.	do.	.59	Cloudy—rain.
	6	57	70	.90	.90	W.	do.		Flying clouds—clear.
	7	56	75	30.05	30.05	W.	do.		Clear—do.
	8	60	75	29.96	29.96	W.	Brisk.		Cloudy—clear.
	9	65	77	.95	.95	S.	Moderate.		Cloudy—do.
	10	67	71	.75	.75	S.W.	do.	.18	Cloudy—rain.
☉	11	56	62	.60	.66	W.	Brisk.		Clear—flying clouds.
	12	48	64	30.00	30.00	W.	do.		Clear—do.
	13	48	67	.20	.20	W.	Moderate.		Clear—flying clouds.
	14	48	69	.15	.15	W	do.		Clear—do.
	15	54	76	29.94	29.94	W.	do.		Clear—do.
	16	56	77	.93	.93	W.	do.		Lightly cloudy—clear.
☽	17	56	74	.95	.95	S.	Brisk.		Fog—lightly cloudy.
	18	64	67	.75	.75	S.W.	Moderate.	1.00	Rain—do.
	19	56	62	.77	.77	W.	do.		Clear—flying clouds.
	20	48	70	.65	.65	W.	Brisk.	.10	Clear—do.—showery.
	21	50	58	.65	.65	N.W.	Moderate.		Clear—do.
	22	38	57	30.15	30.15	N.W.	do.		Frost—clear.
	23	42	67	.15	.15	W.	do.		Clear—do.
	24	52	68	.20	.20	E.	do.		Clear—do.
⊗	25	48	68	.26	.20	S.E.	do.		Clear—do.
	26	46	68	.26	.20	E.S.W.	do.		Fog—clear.
	27	55	65	29.93	29.93	S.	do.		Cloudy—rain.
	28	48	64	.98	.98	N.W.	do.		Clear—do.
	29	47	67	30.10	30.10	N.W	do.		Lightly cloudy—hazy.
	30	50	66	29.95	29.95	W.	do.		Lightly cloudy—do.
	Mean	53.43	64.70	29.95	29.95			1.970	

	Thermometer.		Barometer.	
Maximum height during the month.	80.	on the 2nd.	30.20 on	the 13th 24th 25th & 26th.
Minimum " "	38.	on the 22nd.	29.65 "	20th & 21st.
Mean	39.06		29.95	

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

DECEMBER, 1840.

	County.	Town.	Observer.	Thermometer.										Barometer.	
				7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Register. Mean.	Register. Days omitted.	7, A. M.	2, P. M.
1	Philadelphia,	Philadelphia,	G. P. Schively,	26.92	35.66	29.98	48.00	16.00	30.85	.	16.00	24.97	.	30.11	30.10
2	Montgomery,														
3	Bucks,	Newtown,	L. H. Parsons,	25.13	35.13	27.32	47.25	10.00	29.19	.	10.00	22.30	.	30.03	30.02
4	Lehigh,														
5	Northampton,	Easton,	Charles Elliot,												
6	Monroe	Stroudsburg,	A. M. Stokes,	20.55	32.22	26.17	50.00	5.00	26.31	11 2/3	5.00	9.71	24	29.51	29.55
7	Pike,	Milford,	Ralph Bull,												
8	Wayne,	Honesdale,	W. Richardson,												
9	Susquehanna,	Silver Lake,	E. Rose,	17.00	23.33	19.45	37.00	1.00	19.93	.	1.00	15.87	.	28.11	28.12
10	Luzerne,	Wilkesbarre,	W. F. Dennis,												
11	Schuylkill,	Port Carbon	P. C. Lyceum,	22.85	35.95	25.10	48.50	6.00	27.96	2/3	6.00	18.58	.	29.35	29.36
12	Berks,	Reading,	C. F. Egelmann,	24.26	32.19	26.87	46.00	11.00	27.77	.	...	...	.	29.83	29.84
13	Chester,	West Chester,	Wm. W. Jefferies,												
14	Delaware,	Haverford,	Haverford School,	25.82	32.41	29.04	49.00	13.00	29.09	3 1/3	10.00	21.84	.	29.59	29.56
15	Lancaster,	Lancaster,	Conservatory of Arts,	24.19	35.36	27.60	49.00	12.50	29.12	.	11.00	20.97	.	29.47	29.45
16	York,														
17	Lebanon,														
18	Dauphin,	Harrisburg,	J. Heisely,	27.51	32.23	30.42	43.00	20.00	30.03	.	17.00	25.23	.	29.81	29.80
19	Northumberland,	Northumberland,	Andrew C. Huston,	23.74	33.32	27.61	44.00	8.00	28.22	.	5.00	19.39	.	29.43	29.41
20	Columbia,	Danville,	C. H. Frick.												
21	Bradford,														
22	Tioga,														
23	Lycoming,														
24	Union,														
25	Mifflin,														
26	Juniata,	Mifflintown,	J. A. Rinkead,	24.30	34.79	25.83	48.00	11.00	28.31	3 1/3	....	....	.	29.52	29.53
27	Perry,														
28	Cumberland,	Carlisle,	Prof. W. H. Allen,												
29	Adams,	Gettysburg,	Prof. M. Jacobs,	22.54	34.05	26.71	47.00	8.00	27.76	.	8.00	20.13	.	29.37	29.35
30	Franklin,														
31	Huntingdon,	Huntingdon,	Prof. Jacob Miller,	23.87	34.70	28.90	50.00	8.00	29.16	2/3	....	....	.	29.33	29.31
32	Centre,	Bellefonte,	John Harris,	22.65	36.22	26.98	50.00	8.00	28.62	12 2/3	....	....	.	29.30	29.25
33	Potter,														
34	M'Kean,	Smithport,	Richard Chadwick,	19.81	28.64	21.64	42.00	—4.00	23.36	.	—7.00	18.10	.	27.94	27.93
35	Clearfield,														
36	Cambria,	Ebensburgh,	Richard Lewis,	18.90	24.62	23.21	49.00	—3.00	22.24	1 2/3	—3.00	17.50	3	27.74	27.77
37	Bedford,	Bedford,	Samuel Brown,	24.27	34.09	27.34	55.00	10.00	28.57	1	....	....	.	29.19	29.17
38	Somerset,	Somerset,	George Mowry,	24.77	31.95	27.14	50.00	4.50	27.95	1 2/3	4.50	21.09	2	27.88	29.87
39	Indiana,	Indiana,	Richard White,	27.77	32.68	25.42	50.00	12.00	28.62	.	....	....	.	28.56	28.56
40	Jefferson,	Rose Cottage,	C. C. Gaskell,												
41	Warren,	Warren,	C. S. Brown,	29.95	35.19	33.26	49.00	10.00	32.80	.	10.00	29.32	.	28.71	28.70
42	Venango,	Franklin,	Wm. Connely,	21.48	31.23	25.97	43.00	—2.00	26.23	.	....	....	.	28.93	28.93
43	Armstrong,														
44	Westmoreland,														
45	Fayette,	Uniontown,	J. P. Weethee,	27.22	35.58	29.10	56.00	7.00	30.63	.	....	....	.	29.06	29.02
46	Green,														
47	Washington,	Cannonsburg,	Prof. A. H. Campbell,												
48	Alleghany,	Pittsburgh,	J. P. Bakewell,	30.77	35.69	31.97	55.00	9.00	32.81	4/5	....	....	.	29.22	29.15
49	Beaver,	Beaver,	James Allison,	27.42	32.61	29.40	50.00	3.00	29.81	1 1/5	....	....	.	29.39	29.37
50	Butler,	Butler,	Jacob Mechling,	28.03	32.45	31.55	48.00	8.00	30.68	.	....	....	.	28.72	28.75
51	Mercer,	West Greenfield,	S. Campbell,												
52	Crawford,	Meadville,	J. Limber,												
53	Erie,	Erie,	Park & Reid,												

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Moon.	Day	Thermometer. 9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Register. Mean.	Register. Days omitted.	Barometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum
	5	29.98	48.00	16.00	30.85	.	16.00	24.97	.	30.11	30.10	30.11	30.53	29.53
	6	27.32	47.25	10.00	29.19	.	10.00	22.30	.	30.03	30.02	30.03	30.47	29.46
	7	26.17	50.00	5.00	26.31	11⅔	5.00	9.71	24	29.51	29.55	29.55	29.80	29.20
	8	19.45	37.00	1.00	19.93	.	1.00	15.87	.	28.11	28.12	28.12	28.30	27.80
	9	25.10	48.50	6.00	27.96	⅔	6.00	18.58	.	29.35	29.36	29.37	29.73	28.79
	10	26.87	46.00	11.00	27.77	.	...	...	.	29.83	29.84	29.83	30.30	29.22
	11	29.04	49.00	13.00	29.09	3⅓	10.00	21.84	.	29.59	29.56	29.58	29.98	29.14
	12	27.60	49.00	12.50	29.12	.	11.00	20.97	.	29.47	29.45	29.47	29.91	28.78
	13													
	14													
	15													
	16													
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	18													
	19													
	20													
	21													
	22	30.42	43.00	20.00	30.05	.	17.00	25.23	.	29.81	29.80	29.80	30.20	29.30
	23	27.61	44.00	8.00	28.22	.	5.00	19.39	.	29.43	29.41	29.43	29.70	28.75
	24													
	25													
	26													
	27													
	28													
☉	29	25.83	48.00	11.00	28.31	3⅓	....	....	.	29.52	29.53	29.54	30.00	28.87
	30													
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	12	26.71	47.00	8.00	27.76	.	8.00	20.13	.	29.37	29.35	29.36	29.75	28.72
	13													
	14													
	15	28.90	50.00	8.00	29.16	⅔	....	....	.	29.33	29.31	29.32	29.76	28.66
☽	16	26.98	50.00	8.00	28.62	12⅔	....	....	.	29.30	29.25	29.30	29.71	28.71
	17													
	18													
	19													
	20	21.64	42.00	—4.00	23.36	.	—7.00	18.10	.	27.94	27.93	27.94	28.30	27.30
	21													
	22													
	23	23.21	49.00	—3.00	22.24	1⅔	—3.00	17.50	3	27.74	27.77	27.73	28.14	27.07
	24	27.34	55.00	10.00	28.57	1	....	....	.	29.19	29.17	29.19	29.55	28.50
⊗	25	27.14	50.00	4.50	27.95	1⅔	4.50	21.09	2	27.88	29.87	27.87	28.20	27.19
	26	25.42	50.00	12.00	28.62	.	....	....	.	28.56	28.56	28.59	29.00	27.90
	27													
	28													
	29	33.26	49.00	10.00	32.80	.	10.00	29.32	.	28.71	28.70	28.71	29.22	28.08
	30	25.97	43.00	—2.00	26.23	.	....	....	.	28.93	28.93	28.95	29.40	28.19
	Mean													
		29.10	56.00	7.00	30.63	.	....	....	.	29.06	29.02	29.02	29.30	28.35
Maximum														
Minimum														
Mean		31.97	55.00	9.00	32.81	⅔	....	....	.	29.22	29.15	29.20	29.58	28.38
		29.40	50.00	3.00	29.81	1⅓	....	....	.	29.39	29.37	29.38	29.80	28.60
		31.55	48.09	8.00	30.68	.	....	....	.	28.72	28.75	28.76	29.10	28.10

ometer.					Weather.							Winds.															Hygrometer.					
	Maximum.	Minimum	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew-point.	Wet Bulb.	Days omitted.	No. of Report.
1	30.53	29.53	30.11	.	16	15	.	....	....	....	..	.....	2⅔	1	2½	.	⅓	.	.	.	⅓	1⅔	6⅓	3⅔	3½	3⅔	4⅔	⅓	.	.	....	.	... .	....	.	1318
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7	29.91	28.78	29.46	.	16⅔	14⅓	.	2	6	....	..	4.230	1⅔	⅓	3⅔	⅓	.	.	⅔	.	3	1⅔	1⅓	1⅓	8⅓	2	5	1	.	.	26.36	.	.....	32.71	.	1334
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